Planning is the key to success - but for whom and how? : action-state orientation and specificity as moderators of implementation intention effects on goal achievement

Abstract

Abstract The present research was conducted in order to identify moderators of implementation intention effects, a flexibly applicable planning strategy. Individual differences and the phrasing of implementation intentions were scrutinized as potential moderators. In Part I we demonstrate in three studies that individual differences in action-state orientation moderate implementation intention effects. Individual differences in action-state orientation reflect relevant differences in self-regulatory competencies. Because action-state orientation makes different predictions about successful performance for different self-regulatory problems, we examined different self-regulatory challenges. As expected, the moderating effect of action-state orientation depended on the respective self-regulatory problem. State oriented individuals needed implementation intentions to initiate goal-directed behavior timely. Action oriented individuals increased their performance in complex decision making with implementation intentions. State oriented individuals however were handicapped in complex decision making when instructed to use implementation intentions. In Part II we scrutinize whether the specificity of implementation intentions moderates their effectiveness. Although we varied the experimental design repeatedly, neither the expected moderation nor implementation intention effects were found in any of the reaction time experiments. We discuss possible reasons for the lack of effects and propose further enhancements for future studies.

Zusammenfassung In der vorliegenden Doktorarbeit wurden potentielle Moderatorvariablen des Implementierungsintentionseffekts untersucht. Implementierungsintentionen gelten als flexibel anwendbare Planungsstrategie, die die Erreichung eines Ziels fördert. Es wurden zum einen personenspezifische Variablen und zum anderen verschiedene Möglichkeiten, Implementierungsintentionen zu formulieren, als mögliche Moderatorvariablen betrachtet. Im ersten Teil wurde in drei Studien gezeigt, dass die personenspezifische Variable Handlungs-Lageorientierung, welche auf Unterschiede in selbstregulatorischen Kompetenzen schliessen lässt, Implementierungsintentionseffekte moderiert. Hierfür wurden verschiedene selbstregulatorisch herausfordernde Situationen untersucht: Zunächst wurde die Initiierung zielgerichteten Verhaltens, dann das Lösen von komplexen Problemen betrachtet. In den präsentierten Studien benötigten lageorientierte Personen Implementierungsintentionen, um zielgerichtetes Verhalten pünktlich zu initiieren, beim Lösen komplexer Probleme wurden sie jedoch durch Implementierungsintentionen behindert, während handlungsorientierte Personen beim Lösen komplexer Probleme von Implementierungsintentionen profitierten. Im zweiten Teil der Arbeit wurde untersucht, ob die Spezifität der Implementierungsintentionen deren Wirksamkeit beeinflusst. Obwohl das experimentelle Design in mehreren Reaktionszeitstudien variiert wurde, konnten weder Implementierungseffekte noch die erwartete moderierende Wirkung der Spezifität gezeigt werden. Es werden mögliche Ursachen für die ausbleibenden Effekte diskutiert.

Planning is the Key to Success – but for Whom and How? Action-State Orientation and Specificity as Moderators of Implementation Intention Effects on Goal Achievement

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Abstract

The present research was conducted in order to identify moderators of implementation intention effects. Forming implementation intentions is a flexibly applicable planning strategy which enhances goal achievement. While the general effectiveness of implementation intentions has been demonstrated in numerous studies, to date only scarce evidence exists for moderating variables. The present research focused on two different types of moderators: Individual differences and the phrasing of implementation intentions. In Part I we demonstrate in three studies that individual differences in action-state orientation moderate implementation intention effects. Individual differences in action-state orientation reflect relevant differences in self-regulatory competencies. Because action-state orientation makes different predictions about successful performance for different self-regulatory problems, we examined two self-regulatory challenges: the timely initiation of goal-directed behavior and decision making for complex problems. As expected, we found that action-state orientation moderated implementation intention effects differentially. Its moderating effect depended on the respective self-regulatory problem. State oriented individuals needed implementation intentions to initiate goal-directed behavior timely. Action oriented individuals increased their performance in complex decision making with implementation intentions. State oriented individuals however were handicapped in complex decision making when instructed to use implementation intentions. In Part II we scrutinize whether the specificity of implementation intentions moderates their effectiveness. Although we varied and enhanced the experimental design repeatedly, neither the expected moderation nor implementation intention effects were found in any of the four reaction time experiments. We discuss possible reasons for the lack of effects and propose further enhancements for future studies.

In conclusion, we successfully broadened the knowledge about the limits and the potential of using implementation intentions. Part I showed that action-state orientation in combination

with the respective self-regulatory problem moderated implementation intention effects. Thus, more attention should be given to individual dispositions and circumstances before recommending the use of implementation intentions or drawing conclusions about their general effectiveness. Concerning the moderating role of specificity, many questions remain open. For example, it is unclear why no implementation intention effects were found. Further research is needed to provide answers and to clarify the relevance of specificity.

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Introduction

People hold strong attitudes and goals, but they often fail to express them in terms of their behavior. For example, despite knowing about the harm done to the atmosphere many people drive their car to work every day. They do this even though they state that they generally care about the environment. This phenomenon has first been encountered in research trying to predict behavior from attitudes people have and has been termed as attitude-behavior inconsistency. Later, it has been examined from a motivational point of view, taking goals into consideration instead of attitudes. Even today, motivational psychology still is busy with scrutinizing all aspects of what is called the intention-behavior gap in this research area. Most popularly, planning is proposed as the key strategy to successfully reach goals. In the following we will start from the beginning, tracing this line of research back from where it started.

Research on the consistency between attitudes and behavior started in the early days of modern psychology. One of the first studies on this has been reported by LaPiere (1934). LaPiere was travelling in the United States in the company of a Chinese couple. Prejudice against the Chinese was common then, and he was worried that they might not find accommodations on the trip. To his surprise they were turned away only once during the trip and were welcomed over 200 times. When LaPiere wrote to the same hotels six months later and formally asked whether they would accommodate Chinese people as much as 92 % refused to do so. This is quite an impressive documentation of how attitudes can differ from (previously shown) behavior. This study provoked further research, leading to inconclusive results concerning the attitude-behavior consistency, sometimes showing attitudes as predictors of behavior, sometimes not (for an overview see Ajzen & Fishbein, 1977). The correspondence between the measurement of attitudes and the measurement of respective behaviors, and the time frame in which behavior had to be enacted were identified as moderators of the relationship (Ajzen & Fishbein, 1977). More precisely, it was shown that attitudes predicted behavior more accurately when attitudes and behavior were measured at

the same level. For example, when predicting the use of public transport, the relationship between attitude and behavior was stronger if attitudes towards public transport were assessed instead of general attitudes concerning environmentally friendly behaviors. Also, the attitude-behavior relation was stronger when attitudes were measured shortly before the behavior was enacted compared to when they were measured at an earlier time. Beyond identification of moderating variables, models were developed which took into account more variables than only attitude in order to predict behavior. The central, and important progress made was that these models considered intentions to be the most relevant and immediate predictors of behavior. Thus, it was recognized that decisions about what people intend to do are more likely to predict behavior than their attitudes alone. The most popular and influential model that takes intentions into account probably is the theory of reasoned action (Fishbein & Ajzen, 1975 cited in Frey, Stahlberg, & Gollwitzer, 2001) and its advancement, the theory of planned behavior (Ajzen & Madden, 1986). In these theories, it is assumed that attitudes do not influence behavior directly but that they are one of several factors influencing a (behavioral) intention. The intention in turn is supposed to be the most proximal predictor of behavior. An intention is influenced by the attitude towards the behavior, the subjective norm concerning the behavior, and, in the theory of planned behavior, the perceived behavioral control. The strength of an intention therefore depends on the combined influence of these factors. The stronger the intention, the more likely is it that the behavior is actually performed. The theory of planned behavior assumes that however strong intentions might be, they are only acted on if there is some perceived behavioral control, thereby adding a direct path from perceived behavioral control to behavior to the indirect one described above. The theory of planned behavior probably might be the best known, but several other theories also see the formation of intentions as the most important factor concerning the enactment of a certain behavior (e.g., Protection Motivation Theory, Rogers, 1983; for overviews see Sheeran, 2002; Sheeran, Webb, & Gollwitzer, 2006).

In general, intentions are decisions to perform certain behaviors or actions. As Triandis (1980) put it, they are instructions people give themselves to behave in certain ways. Gollwitzer (1999) calls them goal intentions[1], as they specify certain (behavioral) outcomes that a person wants to achieve and describes them in the general form "I intend to reach X!". While intentions can significantly predict many different behaviors (see Sheeran, 2002), correlations are never perfect. In a recent meta-analysis of 10 meta-analyses Sheeran found an average correlation of .53, indicating that intentions account on average for 28% of variance in prospective studies. As he points out, relative to the standards employed by J. Cohen (1992) this relates to a "large" effect size, especially as it is likely that the true relationship between intentions and behavior is underestimated due to several measurement artifacts (e.g., lack of compatibility between measurement of intention and behavior; for overviews see Ajzen & Fishbein, 1977; Sheeran, 2002). Thus, one can conclude that intentions do predict behavior satisfactorily.

The Intention-Behavior Gap

As already mentioned above correlations are generally high, but they are never perfect. This leaves a large proportion of variance unexplained. Sheeran's (2002) analysis for example implies that while 28 % of variance is explained, 72 % of variance is left unexplained. The fact that many people fail to reach their intentions despite strong commitment is also reflected in proverbs as "the road to hell is paved with good intentions" or "the spirit is willing, but the flesh is weak". New Year's resolutions can also be regarded as prominent goal intentions that people set themselves. A study found in a community-based sample that 45 % of resolvers reported to have failed after only one month (Norcross, Ratzin, & Payne, 1989). Thus, even though intentions do predict behavior they do not do this perfectly. This is called the intention-behavior gap. It is especially crucial in situations where

[1] Because it is almost impossible to draw a distinct line between the concepts, we are going to use the terms goals and intentions interchangeably for the purpose of this study.

successful enactment of set goal intentions is very important, for example in health behavior (e.g., engaging in regular physical exercise after surgical treatment because of cardiac problems). Also, enhanced goal achievement rates can generally be regarded as good because successful goal attainment enhances general well-being, while failures in goal striving lead to tension and frustration, (e.g., Bandura, 1998; Brunstein, 1993). Sheeran (2002) took a closer look at how this gap occurs. He distinguished between four different groups of goal-strivers: The inclined actors, the disinclined abstainers, the inclined abstainers, and the disinclined actors. The inclined actors are people who want to reach a goal and achieve it. The disinclined abstainers do not care about a certain goal and consequently do not achieve it. These two groups provide consistency between their intentions and behaviors. The inclined abstainers are people who want to reach a goal, but do not achieve it. Finally, the disinclined actors achieve the goal despite not intending to. Re-analyses of data applying this approach revealed that the group of inclined abstainers was responsible for the intention-behavior gap (Sheeran, 2002). This implies two different solutions to bridge this gap. First, we can try to help people to set themselves more effective goals. Many different approaches which can be described as theories concerning the optimal way of setting goals have dealt with this aspect (e.g., the theory of planned behavior, Ajzen, 1991; goal setting theory, Locke & Latham, 1999; goal self-concordance, Sheldon & Elliot, 1999; for an overview see Oettingen & Gollwitzer, 2002). Second, we can examine how the process of goal striving can be supported and enhanced in order to help inclined abstainers to become inclined actors. This shall be examined in more detail in the following.

In order to enhance goal striving processes it is essential to take a closer look at the whole process of goal pursuit. Processes involved in setting goals are not necessarily the same as processes involved in pursuing goals, and people also may encounter more than one problem while striving for their goals. While many theories deal with the question of how people set goals following the classical expectancy x value approach, (e.g., the theory of

planned behavior, Ajzen, 1991; Ajzen & Fishbein, 1977; or the model of risk taking behavior, Atkinson, 1957), Heckhausen (1987), and Gollwitzer (1990) proposed a model integrating the whole process from setting a goal to fulfilling and evaluating it: The Rubicon model of action phases (see Figure 1). They assumed that in a pre-decisional phase the feasibility and desirability of the action determines which of many wishes and desires will then be translated into concrete goals. The pre-actional phase involves planning the when, where, and how of goal pursuit and ends with the initiation of goal-directed action. The actional phase comprises the enactment of the behavior which is evaluated in the final, post-actional phase. Each transition from one phase to another is regarded as a crucial barrier that has to be overcome in order to enter the next phase. Even though every phase holds its own challenges, it becomes clear that with regard to the intention-behavior gap the most important barrier that has to be mastered is the initiation of action. People already have an intention, thereby having overcome the first barrier. The next important step in goal pursuit is to start acting on the goal. Challenges that have to be met in order to overcome this barrier could be lack of opportunities for goal-directed behavior, motivation losses, and plans which have to be made. As soon as the pre-actional phase and consecutive action initiation are successfully mastered, goal-directed action is initiated. Different approaches have been made to look at the self-regulatory problems emerging in the course of preparing for goal-directed action. Two of those will be introduced in the following: One approach takes individual differences into account, the other proposes a flexibly applicable planning strategy.

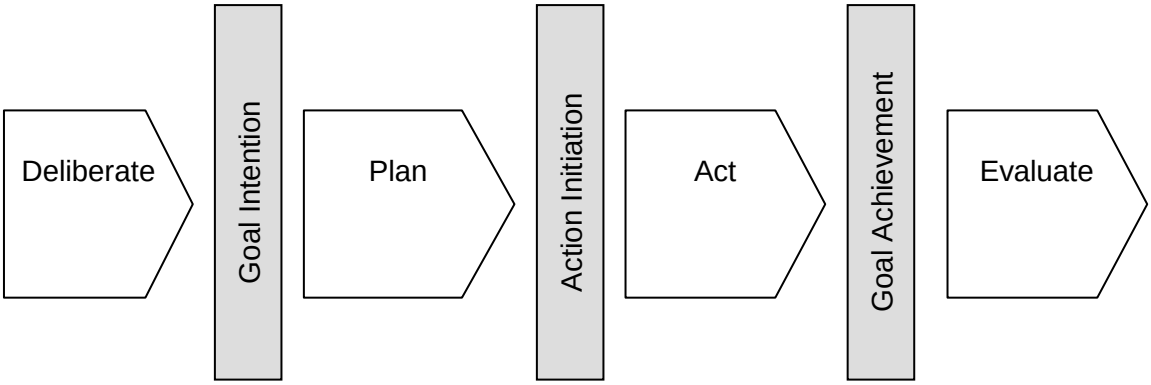

Figure 1. The Rubicon model of action phases (Heckhausen, 1987) depicts different action phases and transition barriers which are encountered during goal pursuit.

Action-State Orientation

A popular approach to self-regulatory problems has been made by Kuhl and colleagues (Kuhl, 1981, 1982; Kuhl & Beckmann, 1994). They focused on the individual differences of action-state orientation. By measuring action-state orientation as a self-regulatory volitional competence, the model predicts who encounters problems initiating goal-directed behavior and who does not. Two types of action-state orientation have been differentiated. Action-state orientation concerning preoccupation (AOP/SOP) reflects the ability to engage in goal-directed behavior after encountering failure or threat to the self. While SOP individuals tend to have intrusive and perseverating thoughts after such events, thus being rather preoccupied and unable to initiate a change of behavior, AOP individuals are well able to cope and they remain capable of acting (Koole, Kuhl, Jostmann, & Vohs, 2005; Kuhl & Beckmann, 1994). The second type of action-state orientation focuses more closely on processes involved in the planning phase of the Rubicon model of action phases. It relates to hesitation and initiative (action-state orientation concerning hesitation, AOH/SOH, Kuhl & Beckmann, 1994). SOH individuals plan excessively and hold on to their intentions. As a result they tend to miss opportunities to initiate relevant action. Also, they have trouble to muster enough positive affect to start acting even if they realize they should (Koole et al.,

2005; Kuhl, 2000). In conclusion, action oriented individuals are better in the initiation of goal-directed behavior because they remain active and deal successfully with the self-regulatory problem of action initiation.

Implementation Intentions

Another very influential approach tackling the self-regulatory problems of initiation of goal-directed behavior has been proposed by Gollwitzer (1993, 1999). Instead of looking at individual differences in action initiation, he suggested a flexibly applicable strategy to overcome the intention-behavior gap, called implementation intentions. Implementation intentions are if-then sentences specifying the when, where, and how of goal pursuit. While goal intentions take the general form of "I intend to reach X!" (see above), implementation intentions can be described by the general sentence "If I encounter situation Y, then I will engage in goal-directed behavior Z!". Throughout the years there has been impressive evidence for their effectiveness, adding to what Zanna and Fazio (1982) call the first generation of questions of a research program. Implementation intentions are effective for a variety of behaviors and goals, including health behaviors like cervical cancer screening (Orbell & Sheeran, 2002) or dietary fat intake (Armitage, 2004), environmental friendly behavior such as travel mode choice (Bamberg, 2002), prosocial behavior (Trötschel & Gollwitzer, 2007), laboratory tasks (Webb & Sheeran, 2007; Wieber & Sassenberg, 2006), and personal goals (Gollwitzer & Brandstätter, 1997; Koestner, Lekes, Powers, & Chicoine, 2002; for an overview see Gollwitzer & Sheeran, 2006). In a recent meta-analysis on 94 studies including a total of 8461 participants, Gollwitzer and Sheeran (2006) found an effect size of d = .65, constituting a medium to large effect according to J. Cohen' s (1992) power primer. This was not significantly diminished when methodological moderators were taken into account, such as type of sample, measurement of goal attainment (self-report versus objective), or publication status. Thus, we can conclude that implementation intentions are generally effective.

Mechanisms of Implementation Intentions

Following the framework proposed by Zanna and Fazio (1982), the second generation of questions asks which mechanisms are responsible for the effects. In fact, implementation intention research has not only started to look for mediating variables, but has been successful in finding them.

It has been claimed earlier on that implementation intentions effectively and successfully enhance goal attainment because they automate the initiation of action (Gollwitzer, 1993). It could be demonstrated that implementation intentions promote goal pursuit immediately, efficiently, and without conscious intent (Aarts & Dijksterhuis, 2000; V. Brandstätter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Brandstätter, 1997), thereby exhibiting features of automaticity. While it has been assumed that perceptual readiness for the specified situational cues and behavioral readiness to enact the goal-directed behavior when the cue is encountered are the processes leading to this automaticity (Gollwitzer & Schaal, 1998), empirical evidence has been provided only recently (Webb & Sheeran, 2007, 2008). Altogether it can be stated that implementation intention research has successfully answered the second generation of questions.

Moderators of Implementation Intentions

We now take a look at the third generation of questions, asking under which circumstances effects occur (Zanna & Fazio, 1982). Some situational factors have been proven to influence the effectiveness of implementation intentions. For example, strength of the respective goal intention as well as its activation (Sheeran, Webb, & Gollwitzer, 2005) increased implementation intention effects. Also, effects were more pronounced when cognitive capacity was limited, either because of added cognitive load (V. Brandstätter et al., 2001, Study 3 & 4) or because of severe individual self-regulatory impairments (opiate addicts under withdrawal or schizophrenics; V. Brandstätter et al., 2001, Study 1& 2). These studies have established basic circumstances under which implementation intentions are

helpful. For one, implementation intentions are not able to corrupt people to do something they do not want to do. If someone does not truly hold a respective goal intention, and is not really committed to it, implementation intentions are of little use (Sheeran et al., 2005). Furthermore, implementation intentions unfold their beneficial effects best when people encounter at least some problems with the initiation of goal-directed behavior (V. Brandstätter et al., 2001). This makes sense, as no bridging of an intention-behavior gap is needed if there are no problems with the enactment of behavior. Also, it is reasonable to assume that automaticity of action initiation would be most helpful when obstacles keep people from consciously initializing the action. Apart from research on such general situational limits there has only been scarce work on moderating factors. Only few recent studies have considered the matter. In the following, we will consider two different classes of moderators. First, we will regard individual differences which might moderate implementation intention effects. It is important to know whether implementation intentions are beneficial for everyone and if so, whether they are beneficial for everyone to the same extent. Then we take a closer look at moderation through aspects of the implementation intention itself. Specifically we explore the phrasing of the implementation intention, as this has been completely neglected in research so far.

It has been shown that implementation intentions are more effective if the superordinate goals are more self-concordant (Koestner et al., 2002). Because the measure of self-concordance reflects how much someone really identifies with a goal, these results can be regarded as further evidence that people have to be committed to the superordinate goal (see above). Self-concordance can also be seen as an individual difference variable, but so far no study has tested whether a person’s general self-concordance moderates the effects of implementation intentions. Instead, Koestner et al. measured how self-concordant different goals are, leaving open the question of individual differences.

Recently Webb, Christian, and Armitage (2007) have taken general personality traits into account. They showed that students who are low to moderate in conscientiousness profit more from an implementation intention intervention than students who are high in conscientiousness in terms of regular class room attendance. The authors suggest that conscientious people have an increased general planfulness, but they also mention that conscientious people are more committed to goals. They conclude that further research is needed to reveal which aspects of conscientiousness promote the effect (self-determination, organization etc.; Webb et al., 2007). Moreover, the moderating role of conscientiousness has only been demonstrated for class-room attendance, not for any other behavior. Thus, the first step has been taken towards identifying conscientiousness as a relevant individual differences variable. The underlying mechanisms however are not yet understood and it remains unclear whether this moderation applies to a wider range of behaviors.

In a similar line of research, Powers, Koestner, and Topciu (2005) have examined whether perfectionism moderates implementation intention effects. For personal goals they found that a certain subgroup of perfectionists (socially prescribed perfectionists) were impeded in progress on their goals when they were instructed to form implementation intentions. This time, the moderating role of socially prescribed perfectionism was tested only with regard to a certain type of goal, that is, personal goals. Whether socially prescribed perfectionism also moderates implementation intention effects promoting other goals and tasks (e.g., performance in laboratory tasks) remains open.

Thus, we conclude that first attempts have been made to identify individual differences as moderating variables. Even though these attempts were fruitful, it remains unclear whether the variables in question also moderate implementation intention effects for other behaviors and goals. It is not yet understood which of aspects of conscientiousness have a self-regulatory impact on behavior, and the question whether conscientiousness has moderating effects on other self-regulatory problems remains open. It seems unlikely that

socially prescribed perfectionism influences a comprehensive range of behaviors (e.g., taking vitamin pills can not be regarded as a genuinely social behavior). We were interested in examining whether an individual difference which is conceptualized to assess self-regulatory competence directly and comprehensively moderates implementation intentions. Because action-state orientation validly predicts behavior in various situations demanding self-regulation, we examined whether it interacts with implementation intentions concerning the promotion of goal-directed behavior. Also, we explored whether this moderation would hold for more than one self-regulatory problem. In Part I we tested whether action-state orientation moderated the effectiveness of implementation intentions for two different self-regulatory problems.

Secondly, we were interested in whether the phrasing of implementation intentions would moderate their effectiveness. While much research has considered the question of their general effectiveness, almost no studies have looked at how exactly an implementation intention should be phrased in order to be most effective. Most studies examined whether a group instructed to form implementation intentions differed from a control group with regard to goal-directed behavior. Different studies concerning various goals and tasks used slightly different implementation intention instructions. For example, compare implementation intention instructions given by V. Brandstätter et al. (2001, p. 948), “In the relevant implementation-intention condition participants were requested to decide (and report on a sheet of paper) where they wanted to compose their vita, when they wanted to get started with it, and how they wanted to start composing their vita.” with those given by Parks-Stamm, Gollwitzer, and Oettingen (2007, p. 255) “Participants in the implementation intention condition were then read two if–then plans, “If I hear the word ‘Laura,’ then I will immediately press the L; if I hear the word ‘mouse,’ then I will immediately press the M.”. We reasoned that beyond preparing participants for different behaviors, such implementation intention instructions also differed in other features (e.g., whether “I” was used in phrasing or

not, how specific situation and behavior are described). Simple differences in phrasing have not yet been considered, even though some studies compared different types of implementation intentions such as distraction-inhibiting ("ignore") vs. task-facilitating ("increase efforts") implementation intentions (Schaal & Gollwitzer, 1999, cited in Gollwitzer, 1999, p. 500), or action ("switch strategy") vs. reflection ("think about how things have been going with strategy") implementation intentions (Henderson, Gollwitzer, & Oettingen, 2007, p.94). While clearly distraction-inhibiting implementation intentions worked better than task-facilitating implementation intentions (Schaal & Gollwitzer, 1999 cited in Gollwitzer, 1999), it depended on the level of arousal whether an action implementation intention was more beneficial than a reflection implementation intention (for more details see Part II, and Henderson et al., 2007). We believe that at least some of the more subtle differences in phrasing play an important role. Most importantly, research on goals has shown that goals promote behavior better, the more concrete and specific they are set (for an overview see Locke & Latham, 1999). Hence it is plausible to assume that level of specificity also plays a role for implementation intentions. More precisely, the more specific a situation is described in an implementation intention's if-part, the faster it should be recognized when it is encountered, thus leading to faster reactions to it. Even if a situation is described less specifically participants holding such an implementation intention should still outperform control participants. Evidence for this assumption is given by the extensive research demonstrating implementation intention effects regardless of whether the implementation intention is specific or unspecific (see the two examples of implementation intention instructions above). We therefore hypothesize that the level of specificity also moderates implementation intention effects. We will investigate this further in Part II.

Identifying other variables moderating the well established beneficial effects of implementation intentions will not only improve the theoretical basis of implementation intention research but will also have important implications for practical interventions.

Part I

Moderating Implementation Intention Effects: The Helpful Role of Action-State Orientation for Different Self-Regulatory Problems

Abstract

We examined in three studies whether action-state orientation moderated implementation intention effects for different self-regulatory problems. In a correlational study action orientation predicted the initiation of goal-directed behavior. This effect was mediated by spontaneously formed implementation intentions. When implementation intentions were experimentally induced in Study 2, they enhanced the performance of state oriented individuals. With implementation intentions they initiated goal-directed behavior timelier than without. Action oriented individuals performed better than state oriented individuals, but did not further profit when they were instructed to form implementation intentions. Study 3 extended our research to a second self-regulatory problem, complex decision making. State oriented individuals outperformed action oriented individuals in an in-basket task. When instructed to use an implementation intention which implied a simple decision strategy action oriented individuals enhanced their performance. State oriented participants' performance in the in-basket task was good, but suffered from using implementation intentions. We speculate that performance decreases because state oriented strategies for complex decision making interfere with implementation intentions. Results suggest that it is important for research on implementation intentions to take individual differences and respective self-regulatory problems into account.

Goals are powerful predictors of human behavior because they guide and energize action (Ajzen & Madden, 1986; Brunstein, 1993; Heckhausen, 1991; Locke & Latham, 1999; Sheldon & Elliot, 1999). In a recent meta-analysis of several meta-analyses, Sheeran (2002) found that goals have a medium to large effect on behavior. He also pointed out that while goals validly predict behavior, this relationship is not perfect. It accounts for 28 % of the variance, but leaves 72 % of variance unexplained. According to Sheeran, this intention-behavior gap is caused by "inclined-abstainers": People who hold strong goals but do not achieve them. This implies that holding strong goals is an auspicious route to goal-directed behavior, but does not guarantee to reach the goal in question. Why could this be the case? What might keep people from reaching goals to which they are really committed?

There are several problems which might be encountered during goal pursuit (cf. Gollwitzer & Sheeran, 2006), for example the goal-directed behavior might not be part of a routine or it might be difficult to enact. People may disregard opportunities to get started on their goals because they are preoccupied with other things, too busy to realize that the time has come to act on the goal. Because of other activities or because of other goal pursuits the activation of the goal in question might be minimal and attention focused on something else. Even if people realize that a situation constitutes a good opportunity to act on their goal, they might be unsure about how to act. They might miss the opportunity because they deliberate too long on what to do. Especially in complex decision-making situations it might be difficult to decide about how to react to the various situational demands. In sum, successful goal pursuit does not only require holding strong goals but also to deal competently with any upcoming hindrances and obstacles (Gollwitzer & Sheeran, 2006); in other words, self-regulation is needed. Because there are

various problems which might emerge during goal pursuit, we assume that different self-regulatory competencies are required, depending on the circumstances and the goals in question.

Throughout the years there have been different approaches examining self-regulation with regard to these different demands. One such approach was made by Gollwitzer (1993, 1999) who proposed a flexibly applicable planning strategy, called implementation intentions. By forming implementation intentions goal-directed behavior can be enhanced and several self-regulatory problems can be overcome. It is assumed that implementation intentions enhance goal-directed behavior in almost every situation and for everyone (Gollwitzer & Sheeran, 2006).

A completely different route was taken by Kuhl and colleagues (Koole et al., 2005; Kuhl, 1981; Kuhl & Beckmann, 1994). They conceptualized an individual differences variable which predicts who self-regulates successfully in which situation: Action-state orientation. It comprehends the measurement of a variety of self-regulatory behaviors in different situations (Diefendorff, Hall, Lord, & Strean, 2000; Kuhl, 1994a). It has been theorized that two different types of action-state orientation exist which support self-regulation in different classes of situations (see below, Koole et al., 2005; Kuhl & Beckmann, 1994).

Even though both approaches have instigated extensive research (for overviews see Gollwitzer & Sheeran, 2006; Koole et al., 2005; Kuhl & Beckmann, 1994), a possible interaction between individual differences in self-regulatory competence and implementation intentions has not been considered yet. We believe that it is fruitful to have a closer look at how two such comprehensive approaches towards self-regulation and goal pursuit interact. Action-state orientation and implementation intentions might support or hinder each other when different types of self-regulatory problems are concerned. Before we explain our hypotheses about interactions in more detail, we will have a closer look at both concepts individually.

Implementation Intentions

Implementation intentions are formed to support a superordinate goal intention which usually takes the general form of “I want to reach goal Z!”. While a goal intention merely describes a desired end-state or accomplishment, an implementation intention further specifies the when, where and how of goal-directed behavior. This is accomplished by an if-then plan which links a good opportunity to a specific goal-directed behavior: “If I encounter good opportunity X, then I will perform goal-directed behavior Y!” (Gollwitzer, 1993, 1999). It has been demonstrated that due to the single act of will which is required to form an implementation intention action initiation becomes swift, effortless, and unconscious, in other words, automatic (V. Brandstätter et al., 2001; Sheeran et al., 2005; Webb & Sheeran, 2004). Therefore, forming implementation intentions helps people to exert volitional control over their behavior without having to endure cognitive costs due to conscious volitional processes promoting goal pursuit (Webb & Sheeran, 2003). Two mechanisms are supposed to be responsible for this automaticity. Firstly, *perceptual readiness* (a heightened attention for related cues) leads to quick and automatic recognition of the specified situation (e.g., Wieber & Sassenberg, 2006). Secondly, people display a *behavioral readiness* to enact the specified behavior once the situation is encountered because of a strong linkage between the situation and the to-be-enacted behavior (Webb & Sheeran, 2007).

Forming implementation intentions is regarded as a powerful beneficial strategy to promote goal-directed behavior despite difficulties or obstacles (Gollwitzer & Sheeran, 2006). This has been demonstrated in laboratory settings (Webb & Sheeran, 2007; Wieber & Sassenberg, 2006), in field experiments (Gollwitzer & Brandstätter, 1997; Holland, Aarts, & Langendam, 2006), or correlational studies (V. Brandstätter, Heimbeck, Malzacher, & Frese,

2003; Gollwitzer & Sheeran, 2006). Implementation intentions are also effective for different action phases (Gollwitzer & Sheeran, 2006): Even though their effectiveness has mostly been demonstrated for the initiation of goal-directed behavior, they also help people to shield ongoing goal-pursuit from unwanted influences or to disengage timely from a failing course of action (Achtziger, Gollwitzer, & Sheeran, 2008; Henderson et al., 2007; Trötschel & Gollwitzer, 2007; for an overview see Gollwitzer & Sheeran, 2006). Finally, implementation intentions work for different types of goals (e.g., for health goals, consumer goals, assigned task-goals in the laboratory, and personal goals; Gollwitzer & Sheeran, 2006).

In sum it can be stated that the effectiveness of implementation intentions has been widely proven and mechanisms promoting these effects have been identified. Additionally, some goal attributes have been discussed as important preconditions for the effectiveness of implementation intentions. It has been shown that some commitment or basic motivation to reach the superordinate goal is necessary (Gollwitzer & Schaal, 1998; Sheeran et al., 2005). Also, implementation intentions particularly enfold a beneficial effect if it is difficult to reach the goal (Bayer & Gollwitzer, 2007).

There has however been only scarce research on the role of individual differences. The question for whom implementation intentions are beneficial has not yet been scrutinized. In a recent study, conscientiousness has been identified as a moderator of implementation intention effects on regular class room attendance (Webb et al., 2007). Low to moderate conscientious students gained more profit from using an implementation intention than those high in conscientiousness. The authors reason that the subcomponent of conscientiousness which influences self-regulation remains to be identified (e.g., heightened general planfulness, self-determination; Webb et al., 2007). Even though it has been demonstrated that a personality trait

moderates implementation intention effects two relevant aspects remain unclear. First, the self-regulatory processes involved are not yet understood. Second, it has not been shown if the moderation applies to other behaviors than class attendance.

Another study showed that implementation intentions had detrimental effects for people high on a particular dimension of perfectionism (socially prescribed perfectionism; Powers et al., 2005). Socially prescribed perfectionists feel a need to attain standards or expectations prescribed by significant others. For example, an item from the Multidimensional Perfectionism Scale (Hewitt & Flett, 1991) measuring socially prescribed perfectionisms is “Anything I do that is less than excellent will be seen as poor work by those around me”. Persons scoring high on such items were at a disadvantage when they used implementation intentions to reach their goals. Socially prescribed perfectionism however is a rather narrow concept, influencing only a limited range of self-regulatory behavior: Many goals are not predominantly social (e.g., taking vitamin pills regularly).

We conclude that first steps have been taken to identify individual differences moderating implementation intention effects. But none of these studies measured self-regulatory competence comprehensively and directly. Therefore, it is necessary to scrutinize the self-regulatory processes involved in order to learn how they interact with implementation intentions. It seems promising to examine action-state orientation as a moderating variable because it is probably the most thoroughly researched individual difference influencing goal-pursuit and self-regulation. Because of this it can be linked in various ways with implementation intention effects.

Action-State Orientation

Action-state orientation determines how successful people are in initiating goals, dealing with diversions, persisting in face of difficulties and disengaging from failing courses of action,

or in other words, in self-regulation (Kuhl & Fuhrmann, 1998). Consequences of action-state orientation have been well examined during the last decades, but research has focused mostly on the advantages of action orientation (Diefendorff, 2004; Koole et al., 2005; Kuhl, 1982, 1986; Kuhl & Beckmann, 1994). Neither advantages of state orientation nor disadvantages of action orientation have attracted a lot of interest (cf. Koole et al., 2005).

As successful performance in the face of different self-regulatory problems (e.g., initiating behavior and overcoming failure) involves very different competencies (e.g., getting started and sustaining motivation), two types of action-state orientation have been established. Each of these distinguishes between action oriented and state oriented individuals but for different self-regulatory problems. The first type of action-state orientation concerns *competencies in planning and initiation of goal-directed behavior* and therefore relates to the self-regulatory problem of action initiation. People showing swift and effortless initiation of action are action oriented (concerning hesitation, see below). They are supposed to recognize good opportunities for goal-directed behavior swiftly (Kuhl, 1994b). Their state oriented counterparts might also recognize an opportunity, but they are expected to have problems with the initiation of action. Instead, they spend more time and energy with excessive decision-making (Kuhl, 1994b). Consequently, state oriented individuals are more precise planners, consider many aspects of a problem, and think it over and over again before they reach a decision (Kuhl & Beckmann, 1983). While this behavior is cumbersome for timely initiation of action, it is beneficial in complex decision making situations (Beckmann & Kuhl, 1984; Koole et al., 2005; Kuhl & Beckmann, 1983). This first type of action-state orientation is named after its state oriented pole, action orientation or state orientation concerning *hesitation* (cf. Koole et al., 2005; Kuhl, 1994b).

The second type of action-state orientation concerns the self-regulatory *task of dealing with failure or threat to the self*. People are said to be action oriented if they do not have problems to access their self even after prior failure. Access to the self is needed to put failure into the context of previous successes and failures and thus calms the person down. Staying preoccupied with recurring thoughts of negative events is descriptive for state orientation. Therefore, this type of action-state orientation is called *preoccupation*, after its state oriented pole (cf. Koole et al., 2005).

It is evident that hesitation-related action-state orientation (AOH/SOH) is influencing goal-pursuit more strongly than preoccupation-related action-state orientation (AOP/SOP) if no frustration or threat is induced or experienced. There have been studies demonstrating that SOH individuals are more circumspect than AOH individuals when making complex decisions (Beckmann & Kuhl, 1984; Kuhl & Beckmann, 1983), but the hypothesis that AOH people are better than SOH people in initiating goal-directed behavior has not yet been proven empirically. Consequently, the differential benefit of AOH/SOH for different self-regulatory problems remains to be shown (Koole et al., 2005).

In conclusion we assume that action-state orientation concerning hesitation differentially predicts performance for different self-regulatory problems. With regard to the *initiation of behavior* AOH individuals are supposed to be at an advantage. Concerning *complex decision making problems* we expect SOH individuals to perform better than AOH individuals. AOP/SOP is not supposed to be relevant, neither for the initiation of goal-directed behavior nor for complex decision making, as long as individuals do not encounter substantial failure.

Present Research

The present research addressed three short-comings of recent studies. First, we explored the assumption that AOH/SOH has a differential advantage depending on the respective self-regulatory problem. Until now, research on action-state orientation has neglected potential benefits of state orientation and instead focused on the advantages of action orientation (Koole et al., 2005). We intend to show that SOH is beneficial for complex decision making. Furthermore, the beneficial effect of AOH on initiation of goal-directed behavior has not yet been empirically demonstrated, since most research concentrated on AOP/SOP and self-regulation in the face of failure or threat (Baumann & Kuhl, 2002, 2003, 2005; Kazen, Baumann, & Kuhl, 2003; Koole & Jostmann, 2004). In our studies we examine two self-regulatory problems: the initiation of action, in which AOH individuals are expected to fare well, and complex decision making, for which it is supposed that SOH individuals are good at it. AOP/SOP should not influence performance on these problems.

Second, it has not been examined yet whether implementation intention effects are moderated by an individual difference which directly relates to self-regulatory competencies. We are therefore interested in whether AOH/SOH moderates the effects of implementation intentions. We assume that this moderation works differently for different self-regulatory problems. When timely initiation of action is required, we hypothesize that AOH individuals perform well, regardless of whether they hold implementation intentions. SOH individuals are expected to benefit from using implementation intentions which support the initiation of goal-directed behavior. Concerning complex decision making, we assume that SOH individuals are reaching better decisions than AOH individuals because they deliberate more circumspectly. This is supposed to be the case regardless of whether they formed implementation intentions or

not because AOH individuals are faster, but less circumspect when they decide about complex problems (Beckmann & Kuhl, 1984; Koole et al., 2005). If they are given an implementation intention which supports the application of an optimal decision strategy, they are expected to enhance their performance. Taken together, we hypothesize that implementation intentions exert beneficial effects on action initiation for SOH individuals and on complex decision making for AOH individuals.

Third, by showing this moderating effect we enhance the knowledge about implementation intentions. If action-state orientation moderates implementation intention effects, this broadens the theoretical understanding of the potential and the limits of using implementation intentions.

In order to test our hypotheses we examined both self-regulatory problems (timely initiation of action and complex decision making) in separate studies. Both types of action-state orientation were measured in order to show that AOH/SOH influences performance but not AOP/SOP, and that AOH/SOH exhibits differential effects on the different self-regulatory behaviors. In a correlational study we explored whether action-state orientation predicted timely initiation of action (Study 1). Additionally, we measured the spontaneous forming of implementation intentions. In Study 2 implementation intentions were experimentally induced in order to prove the hypothesized moderation by action-state orientation on timely initiation of goal-directed behavior. Finally, we examined the self-regulatory problem of complex decision making in Study 3. We induced implementation intentions and measured action-state orientation, again testing for moderation but expecting another data pattern than in Study 2.

Study 1 – Planning Personal Goals

Although theory predicts that AOH individuals are better in initiating goal-directed behavior, this has not yet been proven empirically. Thus we tested this hypothesis in a correlational study, using the personal goals approach (Emmons, 1996; Little, 1998). We asked students to indicate two study goals and two leisure time goals they wanted to reach during that semester. In order to act on these goals, students had to remember the initiation of goal-directed behavior whenever a suitable opportunity arose during their everyday life. AOH students were expected to do better than SOH students. Additionally, we explored the spontaneous use of implementation intentions by asking participants to indicate how detailed they had already planned out when, where and how they intended to pursue their goals. We followed students throughout the semester and measured the degree of goal progress.

Method

Participants. In this study, 333 students (263 women, 69 men, one who did not indicate gender) filled in a first questionnaire a few weeks after start of semester. Of these, 50 failed to fill in the second questionnaire. So finally, 283 participants (228 women and 55 men) provided complete data sets which were used for analyses. Participants who failed to complete the questionnaires did not differ systematically on any relevant variable from those who provided complete data sets. Most participants (83%) were freshman students, with a mean age of 23 years (SD = 7). Students received extra credit in return for participation.

Procedure. Students were approached in an introductory course in psychology and asked to take part in the study. They were given a web-link so that they could fill in the first questionnaire (t1). At the end of the questionnaire, they were asked to indicate their email address, and from then on they were notified of the next data collections via email. Nevertheless,

the email addresses were not linked to the questionnaire data so that participants remained anonymous. Throughout the semester, participants had to fill in three online questionnaires. The first data collection took place in November, five weeks after semester started (t1), the second one three weeks later in December (t2) and the last one another four weeks later in January (t3).

Goals. In the first questionnaire participants were asked to write down two study goals and two leisure time goals they intended to achieve during that semester. For each of these goals they indicated a keyword. These keywords were then repeated throughout the questionnaires whenever participants were asked to answer questions concerning their various goals, e.g., rating goal progress for one of their study goals. The descriptions of the goals and the respective keywords were repeated at the beginning of all further questionnaires.

Action Orientation. Action-state orientation was assessed with the German version of the Action Control Scale at t2 (ACS-90; German: HAKEMP-90; Diefendorff et al., 2000; Kuhl, 1994a). The scale consists of 24 items, 12 each for AOH and AOP, describing situations and phenomenal concomitants of action and state orientation. Participants have to choose which type of behavior they commonly display in a situation like the one described. For example, for the situation “When I actually should work at home” participants can choose between “(a) I have trouble to start on the work.” (SOH) or “(b) I usually start without further ado” (AOH). Action oriented answers are summed to form the action-state orientation indices for hesitation (AOH/SOH) and preoccupation (AOP/SOP), higher numbers indicating action orientation, lower numbers state orientation. Both indices were reliable (Cronbach’s α = .73 and α = .71, respectively).

Implementation Intentions. We measured implementation intentions in all three questionnaires with three items for each of the four goals. Participants had to indicate on a rating

scale ranging from 1 (“not at all”) to 5 (“very much”) how detailed they had already decided about (a) “Mode: How detailed did you already plan out HOW you intend to act upon your matter of concern?”, (b) “Point in time: How detailed did you already plan out WHEN you intend to act upon your matter of concern?”, and (c) “Place: How detailed did you already plan out WHERE you intend to act upon your matter of concern?”. Because reliabilities were good at t1, t2, and t3 (Cronbach’s α = .84, .85, and .87 respectively), we computed means as implementation intention indices for every testing period separately and an overall implementation intention index.

Measurement of goal progress. Progress in goal pursuit was also measured in all three questionnaires. Participants were asked to write down how much they had already achieved in their matter of concern (“How much, in per cent, have you already achieved?”). Internal consistencies across the four goals at all three testing periods as measured by coefficient α were acceptable (.68, .65, and .65, respectively). We computed means as goal progress indices for every testing period separately and an overall goal progress index.

Results and Brief Discussion

To test our hypothesis we regressed overall goal progress on AOH. As assumed AOH predicted goal progress significantly, $\beta = .18$, $F(1,282) = 9.83$, $p = .002$. Interestingly, this effect was mediated by the spontaneous formation of implementation intentions. Following the procedure described by Baron and Kenny (1986), we tested all other regressions necessary to show mediation. We regressed the proposed mediator (the overall implementation intention index) on AOH. This regression was significant, $\beta = .24$, $F(1,282) = 17.59$, $p < .001$. Because we have already shown that AOH predicted goal progress, we now regressed goal progress on AOH and the overall implementation intention index simultaneously. Implementation intentions still

predicted goal progress significantly (β = .24, $p < .001$), while the effect of AOH was reduced to marginal significance (β = .11, $p = .057$). Finally, the Sobel test validated this as a significant decrement, Sobel $z = 5.18$, $p < .001$, indicating mediation (see Figure 2).

We repeated these analyses, taking different measurement times into account. Because AOH was assessed at t2, we focused on predicting goal progress at t3 by AOH with implementation intentions at t2 as mediator. First, we regressed goal progress (t3) on AOH, β = .20, $F(1,282) = 11.60$, $p = .001$. Then implementation intentions at t2 were regressed on AOH, β = .21, $F(1,282) = 13.41$, $p < .001$. When entering both AOH and implementation intentions (t2) as predictors, again the effect of implementation intentions on goal progress (t3) became significant (β = .30, $p < .001$), while the effect of AOH on goal progress (t3) was reduced but remained significant (β = .14, $p = .02$). Finally, we conducted a Sobel test which became significant (Sobel $z = 3.00$, $p = .003$), stating partial mediation.

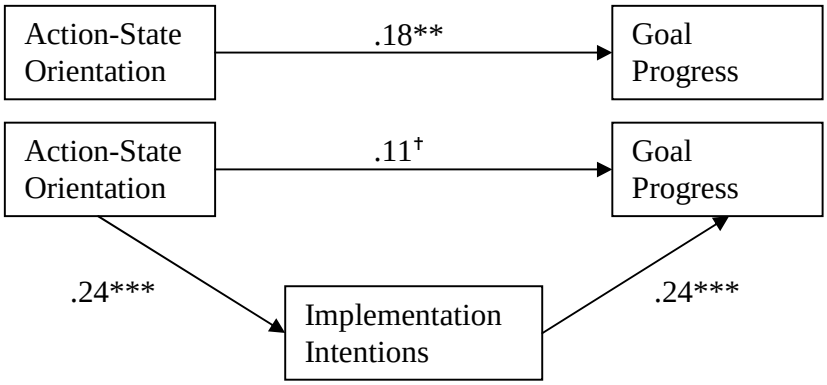

Figure 2. The mediation model with implementation intentions (overall index) mediating the effect of hesitation-related action-state orientation on overall goal progress (Study 1). † $p = .06$, ** $p < .01$, *** $p < .001$

We repeated all regression analyses with AOP instead of AOH. Regardless of different measurement times AOP always predicted implementation intentions significantly but never goal progress. Therefore, it was not reasonable to test for mediation.

In sum, Study 1 confirmed the assumption that AOH individuals are better in initiating goal-directed behavior than SOH individuals. The more action oriented students were the more progress they made towards their respective goals. Additionally, we found that the prediction of goal progress by AOH/SOH was mediated by implementation intentions. AOH individuals made more precise plans about when, where, and how to act on their goals. This in turn resulted in enhanced goal progress. We can interpret the mediation as reflecting AOH individuals' tendency to be better in detecting and gripping suitable opportunities for goal pursuit. While it is difficult for SOH individuals to initiate behavior, AOH individuals seem to make more progress because they know in more detail how to go on about their goals when it is necessary to self-initiate acting on them.

The present study has some short-comings which have to be considered. First, because of the longitudinal design we only had a measure of goal progress to reflect the initiation of goal-directed behavior. Although the initiation of action is a precondition for making progress on a goal, a more direct measure of the initiation of goal-directed behavior might be more accurate, and is therefore preferable. Second, because we measured the forming of implementation intentions instead of manipulating their use, we cannot conclude whether action or state oriented individuals gain more profit when instructed to use them. Thus, we conducted an experimental study (Study 2) on the self-regulatory problem of initiation of goal-directed behavior, manipulating the use of implementation intentions and applying a better measure of action-initiation.

Study 2 – New Year's Resolutions

In Study 2, we roughly followed the design of previous studies done on implementation intentions and timely remembering to perform an intention (Gollwitzer & Brandstätter, 1997; Koole & Van't Spijker, 2000) and asked students to send us an answering card during Christmas recess. Because Christmas recess is usually a period filled with many different commitments and obligations, we assumed that it was hard for students to remember sending back an answering card in time. Because filling in the answering card did not take long nor required repeated action, we considered the return date to be an appropriate measure of action initiation. We hypothesized that action oriented individuals have less problems than state oriented individuals to remember the task and timely engage in respective action. Forming implementation intentions concerning the initiation of behavior was expected to help state orientated individuals to overcome their deficiency. Because action oriented individuals were predicted to perform well, we did not expect them to initiate action timelier with implementation intentions than without.

Method

Participants. One hundred and nineteen students (50 women, 67 men, and 2 participants who did not indicate their gender) of the University of Zurich and the Swiss Federal Institute of Technology Zurich participated in return for a chocolate bar. Of these, 67 returned their answering card. As two participants failed to fill in their code on the answering card or other relevant information, our final sample consisted of 65 participants (29 women, 36 men) with a mean age of 24 years (*SD* = 5). Participants who did and who did not return their answering card did not differ significantly in any relevant variables. Also, participants who formed an implementation intention did not return their answering cards more often than those who did not, $\chi^2 = .110$, *ns*. This is consistent with findings in similar studies (Gollwitzer & Brandstätter, 1997;

Koole & Van't Spijker, 2000) and reflects the fact that implementation intention participants do not hold a stronger commitment to the general goal of returning the card than control group participants. Instead, it can be assumed that by agreeing to take part in the study all participants committed themselves in the same way to fulfilling its main requirements, that is, sending back the card (Koole & Van't Spijker, 2000).

Procedure. Participants were recruited in cafeterias and student work areas during the week before Christmas. They were told that we were interested in the content of New Year's resolutions and that prior research had revealed that this could be validly assessed only very shortly before New Year's Eve. They were asked to fill in a questionnaire which contained all measures of variables as well as the planning manipulation. After they had completed the questionnaire, they were given an answering card on which they were supposed to fill in their New Year's resolutions during the following week. They were asked to send the card back before New Year's Eve. Then, we offered the opportunity to indicate an email address for those who were interested in the study's results. Finally, they were thanked and given a chocolate bar.

Action Orientation. We measured AOH/SOH with the German short version of the Volitional Components Questionnaire (VCQ; German: SSI-K2; Fröhlich & Kuhl, 2003; Kuhl & Fuhrmann, 1998). The questionnaire contains four items measuring AOH/SOH with higher values indicating SOH. Statements had to be rated on a rating scale ranging from 1 (”applies not at all”) to 4 (”applies very much”; e.g., “If something has to be done I start doing it without hesitation.”, recoded). Internal consistency of the scale was good (α = .79). After recoding two of the items, a sum score was calculated which ranged from 4 to 16 (M = 8.71; SD = 2.58). We computed the score for AOP/SOP following the same rationale (M = 8.96; SD = 2.43). Again, consistency was good for the four items (α = .80).

Planning Manipulation. Embedded in the questionnaire was a so-called planning exercise. We asked all participants to explicitly set themselves the goal to fill in their New Year's resolutions on the answering card and send it back. They were told that experience with previous studies had shown that participants often had trouble remembering to send back the filled in answering card. Therefore, we told them, we wanted to help them remembering by providing a planning exercise. For this planning exercise all participants had to write down a sentence three times in order to memorize it. The content of this sentence differed in accordance to condition. The control group was asked to memorize "In the week between Christmas and New Year's Eve I drop the filled in answering card". The implementation intention group prepared itself by writing "When it's the week between Christmas and New Year's Eve, then I will drop the filled in answering card" [2]. Hence, the groups had exactly the same knowledge about what to do and how. By this rather similar control group we could rule out any effects due to a general information advantage (simply knowing in more detail what to do and when) or priming effects. Participants were randomly assigned to conditions.

Time Difference. As we emphasized the importance of timely filling in the New Year's resolutions, we used the difference between the supposed time interval and the filling in of the answering card as dependent variable. So, if participants indicated they filled in the answering card on a day during the crucial week they scored "0" on the dependent variable. If they filled in the card one day after New Year's Eve they scored "1", if they filled it in two days later they

[2] In German, the same expression (wenn) is used for "if" and "when". Consequently, we cannot be sure whether participants understood the first part of the implementation intention conditionally or temporally. It is however probable that they deduced a temporal meaning because temporal information followed (the week between Christmas and New Year's Eve). Also, half of the implementation intention participants in fact memorized the sentence "When it's an afternoon in the week between Christmas and New Year's Eve, then I will drop the filled in answering card". We were interested in whether a more specific description was more beneficial. Because we did not find any differences by taking this variation into account, we dropped it and calculated all analyses for the two groups of implementation intention participants together.

scored “2” and so on. Overall, participants filled in their answering cards with an average of 0.41 days deviation from the supposed time period (*SD* = 1.24).

Additional Variables. To make sure that participants did not differ in other variables which might cause an advantage or disadvantage in the task, we measured commitment and perceived difficulty of the task. After they had done the planning exercise, participants answered three items concerning their commitment to perform the task (e.g., “How committed do you feel to filling in and sending back the answering card during the week between Christmas and New Year’s Eve?”, α = .76) and two items concerning the difficulty the task posed (e.g., “How difficult will it be for you to fill in and send back the answering card during the week between Christmas and New Year’s Eve?”, *r* = .39, *p* = .001). All items had to be answered on a 5-point rating scale. As consistency was good we calculated means to which we further refer as the commitment index (*M* = 2.36; *SD* = 0.99) and the difficulty index (*M* = 3.22; *SD* = 0.97).

Results and Brief Discussion

Control for Additional Variables. First, we controlled for differences in commitment and perceived difficulty due to SOH or group (implementation intention vs. control group) by using standardized indices and the dummy coded grouping variable (see below). Separate hierarchical regressions on the commitment index and the difficulty index with group, action-state orientation, and the respective interaction term as predictors did not reveal any differences (all $F < 2.2$, $p \geq .13$). Additionally, an ANOVA revealed that even though implementation intention participants (*M* = 8.37; *SD* = 2.11) were slightly more state oriented than control participants (*M* = 9.50; *SD* = 3.36), this difference did not reach significance ($F(1,64) = 2.74$, $p = .103$).

Additionally, we controlled for possible gender effects by adding gender as predictor in a hierarchical regression. As gender neither produced a significant main effect nor any interaction, we computed all further analyses without differentiating between genders.

Main Analyses. We conducted a hierarchical regression analysis on the difference in days. Group (control group = 0; implementation intention group = 1) and the z-transformed SOH score were entered as a first bloc, followed by the interaction in the second bloc. The interaction was formed by creating a product term between the standardized SOH and the dummy coded group variables. There was a significant effect of SOH ($\beta = .52$, $t(61) = 3.13$, $p = .003$) which was qualified by an interaction ($\beta = -.42$, $t(61) = -2.59$, $p = .012$). A simple slopes analysis revealed that SOH control participants sent back their cards with more deviation than AOH control participants (see Figure 3). This tendency was less pronounced for those who had formed an implementation intention.

As expected, neither repeating the analyses with SOP (multiple $R = .06$, $F(3,61) = 1.21$, *ns*) nor adding SOP and the corresponding interaction terms to the above described regression yielded any additional effects.

In line with our hypotheses data showed that AOH participants managed to send back their answering cards timelier than SOH participants, replicating findings from Study 1. By forming an implementation intention SOH participants performed the goal-directed behavior timelier than without. So, when given implementation intentions, SOH participants compensated at least partly for their inability to initiate action timely. However, AOH participants did not gain additional profit from using implementation intentions. There are two possible reasons for this: Either performance was already at ceiling, because AOH participants sent back the answering card very timely and it is impossible to be timelier than “in time”, or AOH participants did not

draw any additional benefit from using implementation intentions because of their already excellent self-regulatory skills.

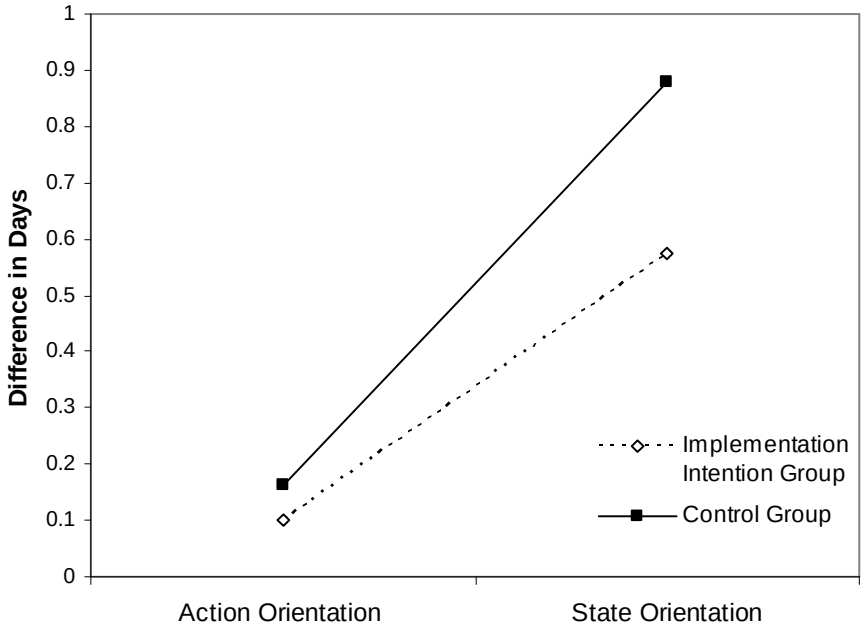

Figure 3. Difference in days as a function of hesitation-related action-state orientation and group (Study 2). Low (action orientation) and high (state orientation) values correspond to one standard deviation below and above the mean.

In conclusion, we confirmed our hypotheses concerning the initiation of goal-directed behavior. The beneficial effect of AOH already found in Study 1 was replicated. Additionally, SOH individuals were able to enhance action initiation when they were given implementation intentions, thereby compensating for their lack of self-regulatory competence. Thus, concerning the initiation of goal-directed behavior, we were able to demonstrate in two studies that AOH predicted better performance than SOH. Furthermore, when implementation intentions were induced their effects were moderated by action-state orientation. The mediation found in Study 1 points at why this might be the case. If we assume that AOH individuals performed well because they decided more precisely about when, where, and how to start acting on their goal, then SOH

individuals should be able to make up their deficits when they were given an implementation intention, a planning tool which specified exactly the when, where, and how of goal pursuit. As we did not include a measure of spontaneously formed implementation intentions in Study 2, we cannot prove that this holds true, but Study 1 firmly indicates that explanation. Nevertheless, further research is needed to ascertain it empirically.

All in all, we could confirm our hypotheses about the initiation of behavior – but what about another self-regulatory problem? We expected that AOH/SOH would predict behavior in another way when different self-regulatory problems were involved. Hence, in Study 3 we examined whether AOH/SOH moderated implementation intention effects for complex decision making.

Study 3 – The In-Box Task

While goal achievement in Studies 1 and 2 required to timely think of initiating goal-directed behavior, there are other tasks which pose different challenges for self-regulation. Very often in everyday life we are involved in rather complex decision making. Therefore, goals may concern not only acting in a certain time frame but also coming to qualitatively good decisions, e.g., about which strategies to apply or which projects to promote. Especially with important decisions, we want to reach the best possible solution. This becomes more difficult the more complex the decision is and the more information has to be considered.

Because it is assumed that SOH individuals do better than AOH individuals in complex decision making, we investigated if implementation intentions could be helpful for AOH individuals, too. In contrast to the self-initiation of behavior, there already is empirical evidence that action-state orientation influences decision making. More precisely, SOH enhances more circumspect decisions (Beckmann & Kuhl, 1984; Kuhl & Beckmann, 1983). In a study requiring

participants to decide on which games of dice they wanted to play, AOH participants tended to rely on a simpler decision rule than SOH participants. The latter always chose the more complex decision rule (Kuhl & Beckmann, 1983). The authors reason that AOH individuals reduce the amount of information quickly in order to bring about a heightened readiness for action. Additionally, Beckmann and Kuhl (1984) showed in another study that AOH participants devalued alternatives once they had taken to an option. This was not the case for SOH participants: Devalued alternatives stayed active in memory as well as chosen options. In other words, options which seemed unattractive at the beginning remained possible choices for SOH participants but not for AOH participants. While these processes pose an advantage for AOH participants if quick initiation of action is required, they might be a hindrance if an optimal decision is needed. Therefore, it is reasoned explicitly in recent theoretical publications that SOH individuals might be better decision makers because they are more circumspect and careful (Koole et al., 2005).

Thus, SOH individuals should perform well in an in-basket task. This complex decision making task is usually used in assessment centers to determine participants' capability to consider and filter a lot of information (Jeserich, 1981). Participants' performance is evaluated in terms of the quality of the decisions they make on the basis of the information. They are provided with many documents which are said to have piled up in their in-basket during an absence from work. They have to read through the documents and decide about their importance as well as about whether and how they want to act. Instead of directly acting upon the information provided, participants have to make a detailed plan of when they want to do what. Usually this is very difficult because some appointments are put in a way that it is impossible to

attend all of them which is not easily discernible. So the task clearly requires participants to make difficult decisions but does not require immediate self-initiated action.

Again we were interested in whether action-state orientation would moderate the effect of implementation intentions, only this time we hypothesized that implementation intentions should be especially beneficial for AOH subjects while SOH participants were supposed to do well on the task without implementation intentions. Because of the different type of self-regulatory problem, implementation intentions were formed which related to a beneficial decision rule once a certain situation was encountered (see below). This has already been proven to be effective for goal pursuit in a negotiation task (Trötschel & Gollwitzer, 2007).

Method

Participants. For this study, 94 psychology students of the University of Zurich (60 women, 33 men and one who did not indicate gender) were approached during an introductory course and offered extra credits for participation as well as feedback about their performance and advice on how to do well in an in-basket task. Due to the manipulation check (see below) we excluded 21 participants who did not remember the planning manipulation properly. Consequently, there remained 73 participants (46 women, 26 men, and one person who did not indicate gender) with a mean age of 24 years (*SD* = 7). Excluded participants differed in none of the relevant variables from included participants.

Procedure. Participants were tested individually in a lab room. We told them we were interested in how well students from different studies did in a task assessing job relevant skills. This was supposed to be important in order to find out which students might need additional training in the course of the newly introduced Master- and Bachelor-System. They were asked to fill in a first questionnaire, containing the planning manipulation, the measure of action-state

orientation, and some additional items, e.g., demographic information. After they had completed it, the experimenter explained shortly about the in-basket task, handed out the material and left the room. Participants had 45 min to work on the task. After time was up the experimenter interrupted them and collected the in-basket material. Next, participants were asked to fill in a second questionnaire which contained the manipulation check. Finally, participants indicated their email address on a separate list, were thanked and fully debriefed.

Action Orientation. Action-state orientation was measured as in Study 1, using the German version of the ACS-90 (HAKEMP-90; Diefendorff et al., 2000; Kuhl, 1994a). Internal consistencies again proved to be good (AOP: Cronbach's α = .72 and AOH: α = .77)

Planning Manipulation. Again we asked all participants to set themselves an explicit goal, this time, to work on the in-basket task as quickly and as accurately as possible. Additionally, we told them that by doing a planning exercise for a certain aspect of the task they could improve their overall performance. All participants were asked to prepare themselves by copying a text and then writing it on the next page by heart, just as in Study 2. For participants in the implementation intention condition this text was "If there's a task that has to be done, and which I don't have to do myself, then I delegate it." In the control condition the text was "There are tasks you have to do yourself and there are tasks that you can delegate. If you delegate a task, this is a good strategy." Participants were randomly assigned to conditions.

Manipulation Check. To make sure that participants encoded the planning exercise correctly, we included a manipulation check in the second questionnaire. Participants were asked to recall the goal and the planning exercise as precisely as they remembered them. Answers were coded with regard to whether participants had or had not remembered the planning exercise correctly. Small deviations like use of abbreviations or omissions of articles were counted as

correct answers. We considered it unproblematic, if participants mixed up the goal intention and the implementation intention as long as they recalled both correctly. Due to this procedure we could identify 23 participants who did not recall the planning exercise properly just after they had finished the in-basket task. We excluded data from these participants from further analyses because their performance in the in-basket task was unlikely to have been influenced by the planning exercise (see above) .

In-Basket Task. We used an in-basket task that had been developed and used in several assessment centers by Kleinmann and colleagues (Klehe, König, Richter, Kleinmann, & Melchers, in press; König, Melchers, Richter, Kleinmann, & Klehe, 2007). It was constructed in accordance to an example given by Jeserich (1981), but modified so that it was situated in a context more realistic for students. Participants were asked to imagine that they arrived at home after returning from an educational trip. Since they had to leave for a business trip to New York the next morning, they needed to look through all their mail and plan how to react during the next 45 min, exactly the time they were allowed to spend on the in-basket task. Afterwards, it was implied they had another two hours for attending to the most urgent things in town. There were 21 different topics for which at least one piece of information was given. In many cases there were several documents providing information on the same topic but hinting at different, conflicting action strategies implying different decisions. For example, there was a letter from the building's administration office informing about a rent increase of 20%. Another letter from an insurance company informed about the possibility of a legal protection for renters which had to be subscribed during the next few days. Finally there was a letter from other renters calling a meeting with a lawyer because of the rent increase. This meeting coincided with yet other topics. Participants had to find the best possible solution in the face of high urgency and very limited

time (in this case the best solution was either to subscribe the defense and recovery or go to the meeting and cancel the other appointment colliding with it). We focused on delegating in the planning exercise because whenever delegation of a task was possible (11 topics), it resulted in the highest possible score for that topic. There was only one exception, in which delegation resulted in the lowest points for that task. However, this task did not earn participants many points, whatever decision they made.

All the material participants handed in was analyzed by research assistants following a written manual provided by Kleinmann and colleagues (personal communication, December 12, 2006) which specified for every possible decision how many points it earned participants (from no points at all up to 50 points). The total score participants achieved in the in-basket task served as criterion variable. In general, participants achieved a low to medium performance with M = 201.01 points (SD = 57.23) out of 525 possible points.

Additional Variables. As in Study 2, we measured some additional variables which had to be answered on a 5-point rating scale. After the planning exercise, we administered the same three commitment items as in Study 2, now, of course, concerning the in-basket task (e.g., “How committed do you feel to working on the in-basket task quickly and correctly?”). Consistency as measured by coefficient α was acceptable (α = .76), therefore we computed a mean score as commitment index (M = 4.10; SD = 0.73). Similarly, we asked participants about the difficulty of the task using the same items as in study 2, again adapted to the in-basket task (e.g., “How difficult will it be for you to work on the in-basket task quickly and correctly?”). We computed a mean score as difficulty index (M = 2.91; SD = 0.65) because the two items correlated significantly, r = .26; p = .03.

Results and Brief Discussion

Control for Additional Variables. As in Study 2, we first controlled for differences in additional variables. Neither z-transformed AOH scores nor group (dummy coded) nor their interaction predicted any differences in commitment (multiple $R = .24$, $F(3,71) = 1.41$, $p = .25$) or perceived difficulty of the task (multiple $R = .20$, $F(3,71) = 0.98$, $p = .41$).

We also tested for gender effects by including gender and the respective interactions in a hierarchical regression on points in the in-basket task. There were neither main effects for gender, nor any significant interactions with it. Therefore, we dropped gender as predictor from further analyses.

Main Analyses. We conducted a hierarchical regression analysis on the in-basket score, entering standardized AOH scores and the dummy coded group variable (0 = control group, 1 = implementation intention group) in the first step and adding the interaction term in the second step. There was a significant main effect of AOH, $\beta = -.33$, $t(69) = -2.26$, $p = .03$, which was qualified by an interaction effect, $\beta = .54$, $t(69) = 3.67$, $p < .001$. Simple slope analyses were conducted to resolve the interaction (see Figure 4). They illustrate that in the control group participants achieved higher scores the more state oriented (SOH) they were, $\beta = -.33$, $t(69) = -2.26$, $p = .03$. When participants had formed implementation intentions, however, it was the other way round. The more action oriented (AOH) they were, the higher the scores they achieved, $\beta = .48$, $t(69) = 2.90$, $p = .005$. Repeating the same analyses with AOP instead of AOH did not yield any significant results.

Thus, forming implementation intentions helped AOH individuals to overcome their disadvantage in solving the in-basket task. But unlike Study 2, implementation intentions did not only have beneficial effects. SOH participants performed well without implementation intentions

but were impeded when they were instructed to form implementation intentions. Because we do not know exactly how SOH managed to reach better decisions it is possible that the strategy implied by our implementation intentions interfered with whatever strategy SOH participants used. Applying a simple decision strategy is what AOH participants prefer (Kuhl & Beckmann, 1983). SOH participants instead favor qualitatively better but more complex strategies. Maybe they had trouble applying a strategy as simple as proposed by the implementation intention.

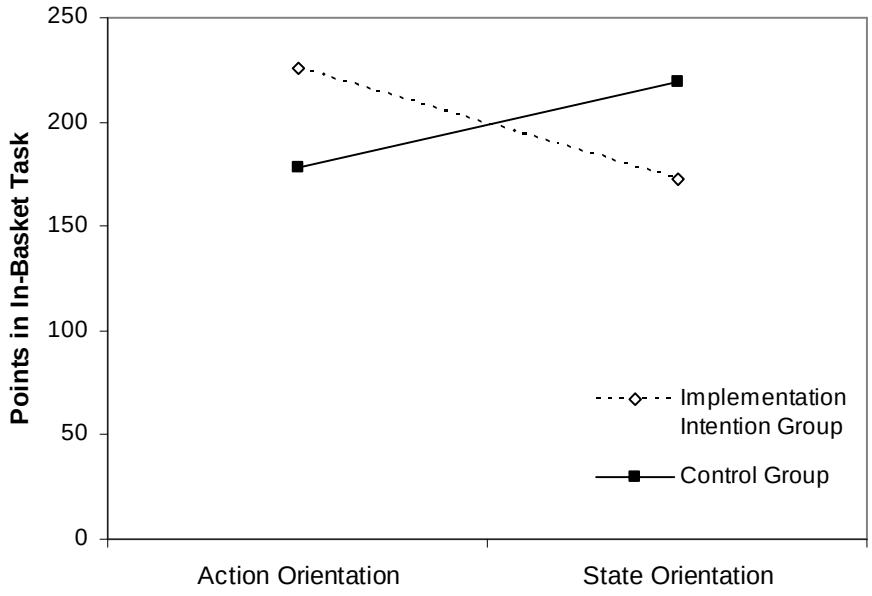

Figure 4. Points in the in-basket task as a function of hesitation-related action-state orientation and group. Low (action orientation) and high (state orientation) values correspond to one standard deviation below and above the mean, respectively.

In sum, we confirmed our hypotheses concerning complex decision making at least partly. AOH/SOH again moderated implementation intention effects. With regard to this self-regulatory problem, SOH individuals performed better because they made more circumspect decisions. AOH individuals did not manage to perform as well in the in-basket task as SOH individuals, but profited considerably from using implementation intentions. Unexpectedly,

implementation intentions did not only enhance decision making. If SOH individuals were instructed to form implementation intentions, their performance decreased in comparison to when they had not formed implementation intentions. Thus, in complex decision making implementation intentions unfolded not only beneficial but also obstructive effects, depending on participants' disposition (AOH or SOH).

General Discussion

We conducted this research in order to test whether action-state orientation, an individual differences variable assessing self-regulation directly and comprehensively, moderated implementation intention effects for different self-regulatory problems. As expected, only AOH/SOH and not AOP/SOP influenced performance because no failure or threat was induced.

In a first study, we were able to confirm that AOH predicted the successful initiation of goal-directed behavior. While SOH individuals were less successful than AOH, AOP/SOP did not relate to action initiation at all. Additionally, the positive effect of AOH on goal progress was mediated by implementation intentions. This attests to the notion that AOH but not SOH individuals are good at identifying suitable opportunities for goal pursuit.

In Study 2 we replicated the positive relationship between AOH and goal achievement. Furthermore, we induced implementation intentions experimentally. Instructed to use this flexibly applicable strategy, SOH individuals were able to compensate their lack of action-initiation competencies. AOH individuals did not gain any additional benefits from using implementation intentions neither did they suffer from forming implementation intentions. Thus, for the self-regulatory challenge of timely initiation of goal-directed behavior, forming implementation intentions constitutes a helpful strategy.

Finally, in Study 3 we examined another self-regulatory problem, complex decision making. Without implementation intentions SOH individuals did better in this task than AOH individuals as had been suggested by previous research (Beckmann & Kuhl, 1984; Kuhl & Beckmann, 1983). Again, AOH/SOH moderated implementation intention effects. This time, AOH individuals were able to compensate their deficits in decision making by using implementation intentions which implied a simple decision rule. Unfortunately, SOH individuals' performance decreased when they used implementation intentions.

Taken together, our studies illuminated two aspects relevant for successful goal pursuit. First, we showed that AOH/SOH predicts different performance depending on the type of self-regulatory problem encountered. While AOH was helpful to self-initiate goal-directed behavior timely (Studies 1 & 2), SOH proved to be beneficial for the quality of decisions in a complex decision making task (Study 3). Hence, our studies demonstrated the different advantages AOH/SOH poses for different types of self-regulatory problems (Koole et al., 2005).

Second, we demonstrated the benefit of using implementation intentions to overcome different self-regulatory problems. Forming implementation intentions aiming at the problems caused by individual differences in self-regulation helps people to overcome these dispositional short-comings. SOH individuals benefited from implementation intentions aiming at timely initiation of goal-directed behavior and AOH individuals improved their quality of decision making substantially by focusing on a simple decision strategy outlined by an implementation intention. Taken together our studies show how beneficial the flexibly applicable volitional strategy of implementation intentions is for different self-regulatory problems. Nevertheless, they also demonstrate limits of the effectiveness of implementation intentions. If self-regulatory skills necessary to master the respective task existed, forming implementation intentions did not lead to

any additional performance improvement. Moreover, SOH individuals performed less well with implementation intentions than without if high quality of decision making was asked for, while AOH subjects were at least not hampered by their implementation intentions concerning timely initiation of action. Thus our studies reveal that it depends on the respective combination of individual difference and self-regulatory problem whether implementation intentions are able to unfold their beneficial effects or not. Forming implementation intentions does not cause any disadvantage for the self-initiation of behavior but is able to help SOH people. The results of Study 3 imply that it is not wise for everyone to form implementation intentions in every situation. In complex decision making situations, like making plans about what to do how, SOH individuals are better advised to refrain from making implementation intentions. We provided data for two different self-regulatory problems, but further research on other problems is needed to find out when and for whom implementation intentions are helpful, hindering, or not causing any effect.

We also gained some additional insights on implementation intentions. First, Study 3 extended the knowledge about which kind of situational cues can be used in implementation intentions. At least for AOH individuals it was possible to improve performance by an implementation intention that required a reflective process rather than a simple recognition process in order to identify the situational cue. Usually, implementation intentions have been formed to recognize a good opportunity by describing the exact situation in which goal-directed behavior should be initiated (e.g., “If I see the number 3, I press the butten especially fast.” V. Brandstätter et al., 2001; Gollwitzer & Brandstätter, 1997; Webb & Sheeran, 2004). In Study 3, however, we asked people to delegate tasks, if they did not have to do these tasks themselves. In order to identify a situation as a good opportunity for the enactment of goal-directed behavior,

participants had to reflect upon the information at hand and to decide whether they had to act on it themselves or if it seemed possible to delegate it. In other word, it was only possible for them to identify the situation as a good opportunity after this foregoing reflection process had been completed. Of course, it is possible that the main benefit of forming implementation intentions in our study lay in instigating this reflection about the respective information. But this seems unlikely because control participants also prepared themselves by considering whether their personal involvement with the task was necessary and were explicitly informed that delegating tasks was a good strategy. We can conclude that implementation intentions focusing on situations which require some reflection to be identified as good opportunities work well.

Second, when comparing the control group and the implementation intention group in Study 3 more closely it becomes evident that providing information about the value of a certain action is not sufficient to enhance self-regulation. Instead, individuals who prepared themselves by forming an if-then sentence which combined a good opportunity with a goal-directed behavior were successful, even if recognition of the situation required some foregoing reflection.

Our findings underline that implementation intentions can be formed for a variety of situational cues and self-regulatory problems. This is in line with recent research demonstrating that implementation intentions can specify inner states as cues, (e.g., fear, Schweiger Gallo & Gollwitzer, 2007), or define a motivational response as the goal-directed behavior (e.g., telling oneself “I can solve the problem!”, Bayer & Gollwitzer, 2007). Even though there have been many studies proving the effectiveness of implementation intentions, there are still not only limitations of their effects but also possible extensions of their applicability that have to be examined in future research.

Of course, our studies have some limitations that need to be considered. While we could identify a mediating mechanism for the relationship between AOH/SOH and timely enactment of goal-directed behavior, we did not empirically provide a mediator for the effect of AOH/SOH on complex decision making. Prior research suggests devaluation of alternative options and (too) quick reduction of amount of information as potential mediators for AOH, but naturally it has to be examined empirically how these might interact with implementation intentions.

Also, results from Study 1 are somewhat in contrast to recent findings concerning spontaneous forming of implementation intentions (de Ridder, de Witt, & Adriaanse, in press). While our study suggests that action oriented participants are better in forming implementation intentions, de Ridder et al. found that state oriented participants made more spontaneous implementation intentions than action oriented participants. However, this apparent discrepancy might be explained by the respective measurements used. In our study, participants indicated how detailed they already had planned out when, where, and how to act on their goals. In other words, we measured the quality of their planning. As implementation intentions are defined as precise plans about the when, where, and how of goal pursuit this seemed plausible. De Ridder et al. also asked participants about the plans they had made about the when, where, and how of goal pursuit, but interpreted their planning index in terms of how many plans participants made. In other words, they rather measured the quantity of their planning. Unfortunately, de Ridder et al. did not include a measure of goal achievement and therefore could not test the corresponding mediation model. Taken together, our studies as well as their results suggest that further research on how exactly action-state orientation and implementation intentions influence goal achievement in a natural setting is necessary.

In conclusion, we showed how beneficial it is for theoretical and practical reasoning to look at two potent predictors of self-regulatory behavior at the same time. Action-state orientation as an individual differences variable moderated implementation intention effects not only for different self-regulatory problems but also in different ways. Consequently, either action or state oriented individuals benefited from using implementation intentions. Additionally, it seems advisable to take into account characteristics of self-regulatory problems more closely in order to predict who will profit from using implementation intentions. Overall, our research highlighted the general effectiveness of implementation intentions in different situations. It also pointed out that regarding circumstances and dispositions more closely helps to make more detailed predictions about who is going to profit from using implementation intentions in which situation – and who should maybe better refrain from doing so under certain circumstances.

Part II

Make Plans to Prosper – But How?

Specificity of Implementation Intentions

Abstract

We conducted four reaction time experiments in order to identify a moderator of implementation intention effects. Specifically, we examined whether the specificity of implementation intentions influenced their effectiveness. In the first three studies participants reacted to different categories of pictorial stimuli in a computerized task. They were instructed to plan their reactions either by forming implementation intentions (implementation intention group) or by doing an irrelevant planning exercise (control group). For both groups, different levels of planning specificity were realized. Studies 1 to 3 differed with regard to the number of specificity levels, the stimuli which were used, the number of trials per task, and the instructions given to the control group. These variations brought about neither the expected moderation nor implementation intention effects. In Study 4 the same design was applied, but a more complex monitoring task was used. This did not lead to significant results either. Because there were no implementation intention effects no conclusions can be drawn concerning the moderating role of specificity. We discuss possible explanations and propose further enhancements.

Introduction

During the last decade numerous studies have demonstrated that using implementation intentions is an effective means to enhance goal achievement (Gollwitzer & Sheeran, 2006; Webb & Sheeran, 2008). An implementation intention is defined as an if-then plan that specifies when, where, and how a goal will be pursued. It is formed in the service of a superordinate goal intention. A goal intention takes the general form of "I want to reach X!" and thereby specifies a desired end state or accomplishment. An implementation intention, however, takes the general form of "If/When I encounter situation Y, then I will show behavior Z.". While the if-part specifies a situation constituting a good opportunity for goal pursuit, an appropriate goal-directed behavior is identified in the then-part. It is reasoned that forming such if-then plans enhances goal achievement because it leads to automaticity of action initiation. Due to the act of will required to form an implementation intention, the previously specified situation is identified fast and without conscious effort (Aarts, Dijksterhuis, & Midden, 1999; Wieber & Sassenberg, 2006) and the goal-directed behavior is enacted automatically (Gollwitzer, Bayer, & McCulloch, 2005; Webb & Sheeran, 2007). This could be demonstrated for different behavioral domains, for example, health behavior, consumer behavior, prejudiced behavior, negotiations, and laboratory tasks (for an overview see Gollwitzer & Sheeran, 2006). Implementation intentions can also be used to initiate action, to shield an ongoing goal pursuit from distractions, or to abandon a failing course of action (Achtziger et al., 2008; Gollwitzer & Sheeran, 2006; Henderson et al., 2007).

While many studies proved the general effectiveness of implementation intentions and some successfully documented mediating mechanisms, so far only very few have looked at moderating circumstances. Zanna and Fazio (1982) outlined that working on a basic problem involves three generations of questions. Proving the general effectiveness of implementation

intentions can be described as the first generation of questions. The proposed second generation of questions, providing mediating mechanisms, has just recently been answered (e.g., Webb & Sheeran, 2007, 2008). The third generation however, identifying moderating variables, has been mostly neglected until now, albeit first evidence has been found and will be reported later.

Two recent publications provide empirical evidence for mediating mechanisms (Webb & Sheeran, 2007, 2008). It has been assumed that implementation intentions heighten the preactivation of the situational stimulus specified in the if-part, thus promoting perceptual readiness. Additionally, the link between the stimulus and the to-be-enacted behavior is supposed to promote behavioral readiness. Both mechanisms are assumed to be responsible for the effectiveness of implementation intentions. Using different paradigms, these authors empirically confirmed that cues to the previously specified situation were perceived preferentially, thereby providing individuals who formed implementation intentions with a perceptual readiness to detect good opportunities for goal pursuit. Additionally, the respective behavior is strongly linked to the situation so that once the situation is identified the behavior is easily enacted. Further, several studies demonstrated that implementation intentions are effective because they operate immediately, efficiently, and without conscious intent (Aarts & Dijksterhuis, 2000; V. Brandstätter et al., 2001; Gollwitzer & Brandstätter, 1997), that is, they exhibit features of automaticity (Bargh, 1994). Automaticity has therefore been proven to be a mechanism of the effectiveness of implementation intentions, too.

There are a few studies concerning moderators of implementation intention effects. In an early study, Gollwitzer and Brandstätter (1997, Study 1) found that implementation intentions are more effective for difficult goals than for easy goals. In another study, Sheeran, Webb, and Gollwitzer (2005) demonstrated that commitment towards the respective goal intention is

essential, and that the intention has to be active in memory. Implementation intentions do not compensate for a lack of wanting to reach the goal; neither do they deceive the goals and the striving of a person. In a similar vein, another study (Koestner et al., 2002) showed that goals have to be self-concordant in order to benefit from implementation intentions. Finally, Webb, Christian, and Armitage (2007) found that low conscientious people benefit more strongly from implementation intentions than high conscientious people.

While some moderating circumstances of implementation intention effects have been explored, another class of moderators has received no attention at all. Specifying the when, where, and how of goal pursuit has been proven to be effective, but the question of how specifically an implementation intention should be phrased in order to be most effective remains open. In other words, until now no one systematically examined whether aspects of the exact phrasing of implementation intentions also moderate implementation intention effects. Specificity is an important attribute as it is already known to benefit goal pursuit (Locke & Latham, 1999). More specific goals, e.g., selling 30 insurance policies next month, are more likely to be reached than less specific goals, e.g., selling as many insurance policies as possible. Therefore, it is likely that effectiveness of implementation intentions also is influenced by their specificity. In fact, implementation intentions can vary in specificity in two ways: The situation in the if-part can be more or less specifically phrased, for example, “if someone is ignored” is less specific than “if no one listens to Toby in the discussion”. Also the behavior in the then-part can be more or less specifically described, for example, “then I will intervene” is less specific than “then I will ask the others whether they do this on purpose”.

In a recent study Henderson et al. (2007, Study 2) varied the specificity of the phrasing of an implementation intention. They examined the specificity of the then-part in a hypothetical

role-play concerning travel mode choice. They instructed participants either to use a simpler action response (“If I get disappointing feedback about my promptness at work, then I’ll switch my mode of travel!”) or a more complex reflection response (“If I get disappointing feedback about my promptness at work, then I’ll think about how things have been going with my mode of travel!”) in the then-part of an implementation intention (Henderson et al., 2007, Study 2). Here, reconsidering the chosen mode of travel is supposed to be a more complex reaction than simply switching the mode of travel. The authors demonstrated that if participants are under pressure in a disengagement situation they profit from the simple action implementation intention but not from the more complex reflection implementation intention. These findings are consistent with research showing that while arousal enhances the enactment of simpler actions, it hinders the enactment of more complex behaviors (Henderson et al., 2007). Because no concrete behavior that solves the problem directly is specified in the more complex implementation intention it can be considered as less specific than the simple implementation intention, in which a specific behavior is outlined. Thus, Henderson et al. (2007) varied the specificity of the then-part of an implementation intention.

However, because the if-part of an implementation intention is held responsible for identification of good opportunities, which is the first step in the process of pursuing a goal, it is important to examine whether its specificity has implications for the effectiveness of implementation intentions. Without realizing that the opportunity for action has come, behavioral readiness (promoted by the then-part of an implementation intention) cannot unfold its beneficial effect. But are implementation intentions comprising low levels of specificity in the if-part still effective? We think they are: As long as a situation is described in sufficient detail to be recognized as good opportunity, a less specific description in the if-part should work in the

proposed manner and promote perceptual readiness. For example, preparing oneself with an implementation intention in order to be especially friendly to a friend called Silvia should work with both if-clauses, “If I meet a friend” and “If I meet Silvia”. Nevertheless, it is also plausible to assume that varying degrees of specificity lead to varying degrees of effectiveness of implementation intentions. However, how exactly does specificity influence the effectiveness of implementation intentions? Under which circumstances are higher levels of specificity helpful? And does high specificity hinder in other circumstances? In this paper we systematically examine the effectiveness of implementation intentions with different levels of specificity, aiming to contribute to a deeper understanding of how the self-regulatory strategy of implementation intentions should be implemented.

Present Research

At a first glance, it is plausible to assume that the more specifically a situation is described in an implementation intention the more easily it is recognized when encountered. This means that high specificity of the if-component will lead to faster and easier detection of critical situations and thereby to better initiation of respective goal-directed behavior. But as mentioned above, implementation intentions are formed to serve a superordinate goal intention. For every goal intention different situations are imaginable in which goal-directed behavior has to be enacted. For example, someone wanting to exercise more regularly will not only want to take the stairs instead of the elevator but will also rather walk a block instead of taking the bus. Thus, describing the situation less specifically might slightly diminish the speed of its recognition as a good opportunity. Instead of quickly checking for a one-to-one match between a given situation and the description used in an implementation intention, some longer consideration might be required for deciding about the relevance of the situation. However, less specificity makes the

implementation intention also applicable to other situations. We hypothesize that less specificity leads to slower recognition of a given situation as a good opportunity to achieve the goal. Consequently, less specificity will also lead to delayed initiation of goal-directed behavior. Additionally, we assume that forming an implementation intention with a less specific if-part allows for its application to more situations, extending the range of the respective implementation intention.

We expected effects due to specificity to be of moderate to small size. Therefore we used a design which enabled us to have maximal control over the occurrence of good opportunities. Precise measurement of the degree of goal-attainment was also instrumental. Thus, we used computerized categorization tasks and measured responses latencies. This paradigm has often been used to detect implementation intention effects. It allows for close control of occurring stimuli and enables very accurate measurement of difference in response speed depending on different specificity levels of implementation intentions.

In three experimental studies (Studies 1-3) we examined the first two hypotheses (i.e., faster goal-directed responses caused by high specificity of the if-part and slower goal-directed responses due to a less specific if-part). In Study 4 we took situations into account which constituted good opportunities with regard to the respective goal intention. A less specific implementation intention was also applicable but not the specific implementation intention given. In other words, we examined whether specific implementation intentions promoted goal-directed behavior in situations for which they were perfectly matched and whether these implementation intentions remained ineffective in situations for which they were not exactly matched but which nonetheless provide good opportunities with regard to the superordinate goal intention.

Study 1

In Study 1 participants were asked to categorize pictorial stimuli with regard to whether a plant or another object was shown. When a plant stimulus was presented we expected participants who formed an implementation intention promoting their reactions to plant stimuli to be faster than participants from the control group. This implementation intention effect should be even more pronounced, when participants were prepared with a more specific implementation intention, focusing not on plants in general but on the rose, which was shown.

The experimental design was a 2 (stimulus: critical vs. distractor) x 2 (group: implementation intention vs. control) x 2 (specificity: flower vs. rose) mixed design with stimulus being a within-subject factor and group and specificity operationalized as between-subject factors.

Method

Participants. We recruited 98 students of the University of Zurich and the Swiss Federal Institute of Technology Zurich. They took part in return for a chocolate bar. Nine participants were excluded because they did not follow the explained procedure or failed to fill in the questionnaire. Three made so many mistakes (see below) that we concluded they had not understood instructions properly and also excluded them. The final sample consisted of 86 participants (50 men, 36 women) with a mean age of 24 years (SD = 5).

Procedure. Participants were approached in cafeterias and student work areas by an experimenter. They were seated in front of a computer and were told that we were interested in how fast different age groups categorized certain stimuli and that they were in the group of young adults. Then they performed a training session on the computer and filled in a paper-

pencil questionnaire including the manipulation of group and specificity before they worked on the main task. Finally, they received the chocolate bar and were fully debriefed.

Stimuli and Task. Participants were asked to categorize pictures. Their task was to decide whether the pictures showed plants or other objects. The pictures were presented in random order and were taken from a children's game called "Memory". All of them had a monochrome background and resembled each other in style and colors (see Figure 5 for examples). Half of the participants had to press the left 'alt' key if the pictures showed a plant and the right 'alt' key if another object was shown. For the other half of participants it was the other way round. All participants were told that for the purpose of this study pictures of fruit or vegetables counted as "other objects".

Figure 5. Examples of stimuli from Study 1. Both roses represent critical items, all other pictures show distractor items.

There were 29 pictures, 27 pictures showed other objects and two pictures depicted plants, each showing a single rose (see Figure 5). The pictures remained on the screen for 1000 ms, or until a response was made. In the training session all 29 pictures were shown once, together with four additional plant pictures which did not appear in the main task. In order to help participants learn the correct answers, there was a sound signal during the training session indicating wrong categorizations. The main task consisted of 10 blocks, one bloc consisting of all 29 pictures presented in random order. Consequently, there were 20 trials with rose pictures (critical trials) and 270 trials with other objects (distractor trials).

Reaction Time Indices. We computed mean reaction time scores (RT) for each trial type. The mean RT for correct responses on critical trials was 517 ms (*SD* = 44 ms), the mean RT for correct responses on distractor trials was 421 ms (*SD* = 58 ms).

Error Indices. We computed separate indices for critical trials and for distractor trials by counting the number of errors made and dividing them by the maximum number of possible mistakes. Indices could vary between 0, indicating no mistakes and 1, indicating that all responses were wrong. After exclusion of three participants with error indices above .90, we received M_{crit} = .22 (*SD* = 0.14) and M_{distr} = .04 (*SD* = 0.09).

Manipulation of Between Factors. The questionnaire included a so-called planning exercise, our manipulation of between-subject conditions. All participants were told that they were to do the planning exercise in order to improve their overall performance. All of them first set themselves the goal to react as quickly and as accurately as possible. Then instructions differed according to condition. The implementation intention group with low specificity was asked to memorize and rewrite "When a flower appears, I press the yellow button as quickly as possible." (flower-implementation intention group). The control group with low specificity memorized "I react as quickly as possible to seeing a flower. I press the yellow button as quickly as possible." (flower-control group). Participants in the high specificity implementation intention group and in the high specificity control group were given the same sentences except that "flower" was replaced with "rose" (rose-implementation intention group and rose-control group). In order to rule out priming effects or information advantages we carefully made sure that each implementation intention group and its respective control group had the same amount of information about what to do and used similar words in the instruction of the planning exercises. However, the control group did not connect the occurrence of the stimulus with a behavioral

response. So they were less well prepared to react quickly than the implementation intention group

Commitment and Difficulty. The questionnaire also contained some items concerning commitment to the task and its perceived difficulty. These questions had to be answered on a rating scale ranging from 1 (not at all) to 5 (very much). Commitment was assessed with three items, e.g., "How committed are you to work on the task as well as possible?". Reliability was acceptable (Cronbach's $\alpha = .76$), the commitment index was $M = 3.98$, $SD = 0.77$. Perceived difficulty was assessed with two items ("How difficult will it be for you to do well on the task?" and "How likely is it that you do well on the task?" reverse coded). Again we formed a difficulty index ($M = 2.74$, $SD = 0.75$) as the items correlated significantly, $r = .43$, $p < .001$.

Table 1

Mean Reaction Times (ms) by Type of Stimulus and Instruction (Study 1)

	Stimuli	
Instruction	Critical Items	Distractor Items
Control Group		
Flower	523 (42)	442 (57)
Rose	525 (45)	418 (52)
Implementation Intention Group		
Flower	515 (44)	409 (53)
Rose	505 (48)	413 (69)

Note: Standard deviations are in parantheses.

Results

Preliminary analyses. To rule out the possibility that our manipulation influenced general commitment to or perceived difficulty of the goal intention, we tested in preliminary

analyses whether the manipulation influenced initial commitment or difficulty. We conducted a 2 (group: implementation intention vs. control) x 2 (specificity: flower vs. rose) between-subject ANOVA on the commitment index and on the index of perceived difficulty. Neither of the analyses yielded any significant result (all *p*s > .15) indicating no influence of our instructions on preliminary commitment or difficulty.

Testing Hypotheses. We conducted a 2-within (stimulus: critical vs. distractor) x 2-between (group: implementation intention vs. control) x 2-between (specificity: flower vs. rose) ANOVA with reaction time as dependent variable (see Table 1) revealing a main effect of stimulus, $F(1,82) = 337.37$, $p < .001$. Participants responded faster to distractor items ($M = 421$ ms) than to critical items ($M = 517$ ms). The hypothesized three way interaction was marginally significant, $F(1,82) = 3.73$, $p = .06$. Simple main comparisons revealed that all comparisons between critical and distractor trials were significant (all *p*s < .001). The only other comparison that was at least marginally significant referred to a contrast for distractor items: Participants in the flower-control group ($M = 442$ ms) reacted marginally slower than participants in the flower-implementation intention group ($M = 409$ ms), $F(1, 82) = 3.87$, $p = .05$.

To control for speed-accuracy trade-off, we repeated the ANOVA with error index as dependent variable. Again, the main effect for stimulus was significant, $F(1, 82) = 95.97$, $p < .001$, indicating that participants were not only faster but also made fewer mistakes on distractor trials ($M = 0.04$) compared to critical trials ($M = 0.22$). The three-way interaction was also significant, $F(1, 82) = 4.39$, $p = .04$. Again, we conducted simple main comparisons. As with reaction times, all contrasts comparing distractor items with critical items became significant (all *p*s < .001). Participants made fewer mistakes on distractor trials than on critical trials within all conditions. No other comparison yielded any significant difference.

Potential Moderators. Because the expected interaction for reaction times only reached marginal significance, we took a number of known moderators of implementation intention effects into account. Maybe implementation intentions were helpful for only certain participants, for example for those high in commitment or those who perceived the task as difficult.

In a further analysis we included the median-split commitment index as additional factor, leading to a 2-within (stimulus: critical vs. distractor) x 2-between (group: implementation intention vs. control) x 2-between (specificity: flower vs. rose) x 2-between (commitment: high vs. low) ANOVA with reaction time as dependent variable. This did not yield a significant four-way interaction, F (1,78) = 2.25, p = .14. Repeating the analysis with the median-split difficulty index instead of the commitment index did not help, either. While it produced two unexpected significant two-way interactions (stimulus by difficulty, F(1,78) = 8.45, p = .01, and group by specificity, F(1,78) = 5.07, p = .03), the four-way interaction remained non-significant, F(1,78) =1.07, p = .30. Thus, neither including commitment nor difficulty helped to clarify the previous findings.

Discussion

We could not confirm our hypotheses concerning the interaction between stimulus, group, and specificity. A high level of specificity did not lead to more pronounced implementation intention effects on critical trials. Instead, analyses led to diverse and unexpected results, which are discussed in more detail.

First, analyses revealed a strong and unexpected advantage for distractor trials over critical trials. Participants were both faster and made fewer errors in distractor trials than in critical trials. This is surprising because all participants prepared themselves somehow for critical trials. Thus, even though we did not expect a main effect for stimulus, it would have been

more plausible if all participants had been faster on critical than on distractor trials. While the control group did not form an implementation intention, their so-called planning exercise could nevertheless have produced a priming effect, resulting in an advantage of critical trials over distractor trials.

The strong main effect might have gotten in the way of clearer implementation intention effects because the goal intention concerning the categorization task, the implementation intention, and the respective response were confounded. Whenever participants had to act for the plant-category as opposed to other objects, they also acted on their implementation intention. In other words, because of the experimental design there were no categorizations possible for plants which were not at the same time reactions according to the implementation intention. Because of this participants used different hands as well for the different categories of objects as for critical items and distractor items. Hence, categorization reactions were confounded with reactions according to the implementation intention.

Critical trials were very rare (overall ratio: 20 critical trials to 270 distractor trials) so that participants rarely had to react to the category of plants, or, in other words, according to their implementation intention. In contrast, there were many distractor trials, requiring repeated other-object responses with the respective hand. This led to participants constantly pressing the button for other objects, while critical trials came more or less as a surprise. This may have produced slower responses and more mistakes. Some participants mentioned after the experiment that they had had trouble reacting to the critical items because they were so rare. The strong main effect as well as the significant simple main comparisons between the types of stimuli might have resulted from this unequal frequency of presentation.

Because implementation intentions were confounded with the respective reactions to the categorization task, the strong main effect of stimulus might have forestalled implementation intention effects. It might also have been impossible for implementation intention participants to speed up responses on the critical trials significantly because of the high frequency of presentation of distractor items.

Despite descriptively reaction times for critical trials looking fine (implementation intention participants were faster than control participants, especially in the rose condition) this comparison did not reach significance. Instead, the only comparison between implementation intention group and control group that was at least marginal significant concerned distractor trials. While the flower-implementation intention group and the rose-implementation intention group as well as the rose-control group were equally fast, the flower-control group was slowed down. In line with our reasoning it could be argued that participants were faster the more specific their planning was, if they had formed an implementation intention. While this produced an advantage for flower-implementation intention participants over flower-control group participants because of the implementation intention effect, the rose-control group's response times were already at ceiling due to specificity. Thus, it was impossible for rose-implementation intention participants to be any faster. Nevertheless, it remains odd and unusual that an implementation intention effect as well as a specificity effect occur for distractor trials, for which participants had not prepared themselves in any special way, but not for critical trials. Maybe our instructions led to a special mind-set, making it easier for participants to reject items for which they had not been prepared. This could have been fostered by the rather vague description of the second category as "other objects". Combined with the high frequency of other objects, it might have made it easier for participants do make decisions about what was not presented in a trial

than to make decisions about what was shown (e.g., “this is no rose” or “this is no flower” instead of “this is an apple”). Although this possibly accounts for the effects on the distractor trials, it does not explain the lack of implementation intention effects for the critical trials.

Regarding errors, it is reassuring that implementation intention participants did not produce more errors than control participants, especially in the conditions in which they were at least descriptively faster. We also tested whether other variables moderated the effect. Unfortunately, neither including commitment nor difficulty brought forth at least an implementation intention effect, regardless of specificity.

We conclude that although we could not confirm our hypothesis, there are at least some promising aspects worthwhile mentioning. While the three-way interaction only reached marginal significance, the descriptive pattern of reaction times was in favor of the supposed effects. Results of errors further supported this idea. The main effect for stimulus produced by the already mentioned confounding of response, goal intention, and implementation intention, might have been too strong and thus covered all other effects. Study 2 addressed the above mentioned problems of Study 1.

Study 2

With Study 2 we sought to eliminate potential problems in the operationalization of Study 1. In Study 2 we relied more strongly on a reaction time paradigm which has already been used in implementation intention research (V. Brandstätter et al., 2001, Study 2; Webb & Sheeran, 2004, Experiments 2 & 3). Two major differences between Study 1 and previous studies had to be considered. First, Brandstätter et al. (2001) and Webb and Sheeran (2004) used only numbers and letters for their categorization task, with implementation intentions supporting one number. Second, their experiments consisted of more trials. Because it was impossible to

phrase implementation intentions of different levels of specificity for numbers and letters, we again relied on pictorial material. Consequently, we had to create more stimuli to provide enough material for a design with equal sized categories and enough trials. Also, we defined the other-object category in more detail; pictures now had to be categorized with regard to living and non-living objects. Finally, we introduced a third level of specificity hoping to be able to test for a linear trend of specificity.

By taking these measures we intended to overcome the operationalization problems of the first study and hoped to gain more reliable and clear results concerning our hypotheses. Accordingly, we followed a 2-within (stimulus: critical vs. distractor) x 2-between (group: implementation intention vs. control) x 3-between (specificity: plant vs. flower vs. rose) design.

Method

Participants. Ninety-seven students of the University of Zurich and the Swiss Federal Institute of Technology Zurich took part in the study in return for a chocolate bar. Sixteen participants were excluded from further analyses because they did not work on the parts of the study in the correct order, had trouble with understanding German or were interrupted during the experiment. The final sample consisted of 81 participants (43 men and 38 women) with a mean age of 24 years (SD = 5)

Procedure. The general procedure was the same as in Study 1.

Stimuli and Task. Again, participants had to work on a categorization task, which resembled the task in Study 1 but with some important changes. The general task this time was to decide whether the pictures shown were living or non-living objects. The number of objects for each category was balanced this time, 20 pictures showed living objects, and 20 pictures showed non-living objects. The pictures were taken from the memory game (see Study 1) or from the

web. Of the living objects, 18 were animals and two were plants (the same two roses as in Study 1). All objects were set on a monochrome background. This resulted in 200 trials with non-living objects (non-critical items), 180 trials with living objects (distractor items), and 20 trials with roses (critical items). In all other aspects the task paralleled the task used in Study 1.

Reaction Time Indices and Error Indices. Becaues we were interested in comparing responses made for the living category we computed reaction time indices for critical (M = 518 ms, SD = 50 ms) and distractor trials (M = 492 ms, SD = 42 ms).

Error indices were computed following the same logic as in Study 1, dividing the number of errors by the number of respective trials (M_{crit} = .08, SD_{crit} = .08, M_{distr} = .04, SD_{distr} = .03).

Manipulation of Between Factors. The goal intention and manipulations were the same as in Study 1, but we included an additional level of specificity. Thus, there were two additional groups of participants preparing themselves either by repeating either "If I see a plant, I press the yellow button as quickly as possible." (plant-implementation intention group) or "I react as quickly as possible to plants. I press the yellow button as quickly as possible." (plant-control group). All other groups had the same instructions as in Study 1, which were "If I see a flower/rose, I press the yellow button as quickly as possible." (flower-implementation intention / rose-implementation intention group) or "I react as quickly as possible to flowers/roses. I press the yellow button as quickly as possible." (flower-control / rose-control group). Before participants received these diverging instructions, all were asked to set themselves the goal to react as quickly and as correctly as possible.

Commitment and Difficulty. Perceived difficulty and commitment were measured with the same items as in Study 1. Items for perceived difficulty correlated significantly (r = .41, p < .001), so we computed a mean score as difficulty index (M = 2.36, SD = 0.64). Commitment was

assessed with one additional item ("How important is it to you to work fast on the task?"). Reliability proved to be acceptable, $\alpha = .73$, so we formed a commitment index by using a mean score ($M = 4.21$, $SD = 0.61$).

Results

Preliminary analyses. We tested whether our manipulations caused changes in preliminary commitment or perceived difficulty, applying a 2 (group: implementation intention vs. control) x 3 (specificity: plant vs. flower vs. rose) between subjects ANOVA for each of the indices. Manipulations did not influence perceived difficulty, but on commitment they produced a marginal significant effect of group, $F(1, 75) = 3.98$, $p = .05$, indicating that implementation intention participants ($M = 4.36$) were slightly more committed than control participants ($M = 4.07$). As commitment did not correlate with reaction time indices (both $r < .11$) and for sake of clarity, we decided against including commitment as covariate in the main analyses.[3]

Testing Hypotheses. We performed a 2-within (stimulus: critical vs. distractor) x 2-between (group: implementation intention vs. control) x 2-between (specificity: flower vs. rose) ANOVA on reaction time (see Table 2). The main effect of stimulus became significant, $F(1, 75) = 63.15$, $p < .001$. As in Study 1, participants responded faster to distractor items ($M = 492$ ms) than to critical items ($M = 518$ ms). Additionally, we found a main effect for specificity, $F(2, 75) = 3.19$, $p = .05$. Pairwise comparisons revealed that the plant condition differed from the flower condition ($p = .04$) which also differed from the rose condition ($p = .02$), while the plant and rose conditions did not differ from each other ($p = .84$). Participants in the flower condition were slower than the other groups. None of the interactions became significant.

[3] Nevertheless, including commitment as covariate in the main analyses did not yield any additional effect.

Conducting the same ANOVA on error indices as dependent variable also led to a significant effect of stimulus, $F(1, 75) = 22.59$, $p < .001$. Participants reacted more accurately to distractor trials ($M = .04$) than to critical trials ($M = .08$). None of the other effects reached significance (all ps > .19).

Table 2

Mean Reaction Times (ms) by Type of Stimulus and Instruction (Study 2)

	Stimuli		
Instruction	Critical Items	Distractor Items	Non-Critical Items
Control Group			
Plant	506 (42)	488 (40)	498 (42)
Flower	547 (64)	511 (45)	525 (45)
Rose	497 (44)	483 (41)	496 (44)
Implementation Intention Group			
Plant	510 (42)	490 (33)	499 (40)
Flower	533 (53)	502 (49)	520 (41)
Rose	521 (47)	491 (42)	501 (45)

Note: Standard deviations are in parantheses.

Potential Moderators. Because there was no implementation intention effect we tested whether commitment or difficulty worked as moderators. Adding the median-split commitment index as factor to the aforementioned ANOVA on reaction times did not produce a significant four-way interaction, $F(2, 69) = 0.62$, *ns*, but two unexpected interactions. Specificity and commitment interacted significantly, $F(2, 69) = 4.23$, $p = .02$, as well as stimulus, specificity and commitment, $F(2, 69) = 3.53$, $p = .04$. This was unexpected and inconsistent with findings from Study 1, we will therefore not discuss it in further detail. Including the median-split difficulty

index as factor instead of commitment did not result in any significant effects at all. Thus, including these two known moderators of implementation intention effects did not help to improve or clarify the pattern of results.

Discussion

The aim of Study 2 was to eliminate potential problems encountered in Study 1. Unfortunately, we could not confirm our hypotheses within this enhanced design either. We did not detect the assumed interaction between stimulus, group, and specificity, which was expected because of larger implementation intention effects at higher levels of specificity on critical trials. What is more, participants did not profit in any way from forming implementation intentions, regardless of level of specificity.

Despite solving the confounding of categorization reactions and implementation intention, we again found a significant main effect for stimulus for reaction times and for errors. Participants were faster and more accurate when responding to distractor items compared to critical items. We compared stimuli which belonged to the same category (living objects). Reactions to these stimuli were executed with the same hand. We therefore cannot apply the explanation mentioned in Study 1, assuming that the main effect for stimulus forestalled implementation intention effects because of the combination of unequal presentation frequencies and the confounding between categorization task and implementation intention. Hence, it is especially surprising that participants reacted slower and less accurately to the critical trials (rose pictures) in comparison to the distractor trials (animal pictures). In contrast to previous implementation intention research (e.g., Webb & Sheeran, 2004), our participants were impeded when deciding upon the two rose items, while they were fast and accurate when deciding upon the other stimuli from the same category, the animal items. Maybe animals are processed

preferentially in comparison to flowers? This does not seem to be the case as an ANOVA on reaction times of the non-living objects instead of the animal distractor items revealed a similar data pattern. Thus, the confounding in Study 1 can no longer be held responsible for this effect. It remains open why this clear advantage for distractor or, more precisely, the disadvantage for critical items occurred. Maybe the rose pictures differed in some important physical attributes from all others, like visual complexity or contrast.

Inspection of reaction times for the specificity main effect revealed that participants reacted faster if they had been prepared to react to plants or roses in comparison to when they had been prepared to react to flowers, regardless of whether they had formed an implementation intention or not. Being prepared to react to flowers slowed participants down. Maybe participants had trouble with the flower pictures. The instructions for the flower condition may have activated a representation of a flower which interfered with the pictures used. As we used roses as critical stimuli, this seems unlikely since roses are considered as very typical flowers. This assumption was confirmed by asking people (N = 10) to name ten flowers freely. Of these, rose and tulip were the flowers named most frequently (10 times each), with rose ranking highest (mean rank = 2.1). Hence, it seems most unlikely that the picture of a rose interfered with participants' representation of the concept "flower" because of lack of typicality. It is still possible that roses were not displayed in a typical way. But the rose stimuli showed mainly the flower and not the whole plant, so this also seems implausible. Nevertheless, research on cognitive processing of objects suggests that the first step of object categorization involves matching the visual input with a stored representation of the object's form and structure (Glaser, 1992; Lloyd-Jones & Humphreys, 1997). Access to this structural representation is needed to access further conceptual information about the object, which is necessary to categorize it. If our

stimuli interfered with the respective structural representation then problems with categorization might have resulted. A more systematic empirical test of the relation between our stimuli and the structural representation of roses in general would be needed to answer this question. If our material was indeed deficient, this might explain an effect for stimulus, but it does not explain the data pattern we received for the main effect showing that participants in the flower condition were slower in comparison to those in the plant and rose conditions, regardless of group. Assuming that these problems with structural representations account for the stimulus effect, participants in the flower condition should have been superior to those in the rose condition because categorical information about pictures (e.g., “this is a flower”) can be retrieved more easily than information about a certain exemplar (e.g., “this is a rose”; Glaser, 1992).

In contrast to Study 1, the descriptive data pattern for errors looked better than the reaction time data. For distractor trials, there seemed to be no difference between conditions while implementation intention participants made fewer mistakes on critical trials, at least for the flower and the rose condition (i.e., for the more specific conditions). In the plant condition, control participants reacted more accurately than implementation intention participants. Unfortunately none of the effects reached significance, so we cannot conclude anything from this pattern of data.

Even though we designed Study 2 in accordance to previous reaction time experiments on implementation intentions and enhanced Study 1 in several ways, we did not find any of the hypothesized effects. Implementation intention participants did not outperform control participants more distinctly on critical trials at higher levels of specificity than at lower levels of specificity. Neither could we detect an implementation intention effect regardless of specificity. Also including the two known moderators commitment and difficulty did not help. Instead, we

got different effects than for the moderator analyses in Study 1. So no consistent pattern of results could be found concerning the role of these potential moderators.

We could not even detect the frequently replicated implementation effect (Gollwitzer & Sheeran, 2006). This suggested that there might still be problems with the experimental design. First, maybe our self-made additional material did not match the previous stimuli exactly in design and colors. Also, our stimuli were not matched or pretested concerning physical attributes such as complexity, contrast, or familiarity of the displayed objects. Second, we do not know for sure whether our participants truly encoded the implementation intention. The complete lack of implementation intention effects (regardless of specificity) could be caused by inattentive encoding of the respective planning exercises, thereby failing to produce a difference between control group and implementation intention group. Third, the control group performed a planning exercise which was designed to rule out alternative explanations such as information advantage or priming effects for the implementation intention effect. Other studies have used less controlled instructions (Webb & Sheeran, 2004), so it is possible that we used a too conservative control group, which paralleled the implementation intention instructions too closely and diminished all effects.

Due to these remaining deficiencies in the experimental design, we conducted another study aiming to further enhance it.

Study 3

We tried to overcome all remaining difficulties with the experimental design in Study 3. To rule out further problems with the stimulus material, we chose stimuli out of a large set of standardized pictures, showing black and white line drawings (Snodgrass & Vanderwart, 1980). Because there were not enough plant pictures in the set, we changed the critical stimulus and its

category. We chose a line-drawing depicting an eagle, which was described to participants either as bird, raptor, or eagle, according to level of specificity. In addition, we included a manipulation check in order to make sure participants truly encoded implementation intentions. Finally, we introduced an additional control group, implementing familiarization instructions, thereby extending the design to a 2-within (stimulus: critical vs. distractor) x 3-between (group: implementation intention vs. control vs. familiarization control) x 3-between (specificity: bird vs. raptor vs. eagle) design.

Method

Participants. We recruited 144 participants in cafeterias and student work areas. In return for participation, they received a chocolate bar and took part in a raffle of several book tokens. We had to exclude 12 participants because of problems during the experimental session (e.g., data loss or false procedure), because of the manipulation check, or because of both. Analyses were carried out on data of the remaining 132 participants (67 women, 64 men and one participant who did not indicate gender in the questionnaire). The mean age was 24 years (*SD* = 3).

Procedure. The general procedure was the same as in Studies 1 and 2, only that participants filled in a second questionnaire containing the manipulation check after they had finished working on the main task.

Stimuli and Task. The task remained mostly unchanged, but we used different stimuli. Participants still had to categorize whether a picture showed a living or a non-living object by pressing the respective key as fast as possible. The items were now chosen from a standardized set of pictures (Snodgrass & Vanderwart, 1980). For these black-and-white line drawings norms are available concerning several of their attributes. As recommended for categorization tasks, we

tried to match critical and distractor items as closely as possible with regard to familiarity and visual complexity (Snodgrass & Vanderwart, 1980). Accordingly, living objects were one bird (eagle, critical item), and six different four-legged animals (lion, camel, rabbit, deer, cow, and monkey, distractor items; see Figure 6). The lion, cow, and monkey were matched closely to the critical item with regard to familiarity and visual complexity, the other three were chosen randomly. We used the eagle drawing as critical item because it was one of the most familiar items, and thus should be easily recognizable. As non-living objects we chose three pictures from each of the categories of musical instruments, carpenter's tools, and vehicles (non-critical items). By using the standardized black-and-white line drawings, the physical attribute of contrast was held constant for all stimuli.

There was one training bloc followed by ten blocs in the experiment proper. Each bloc consisted of the complete set of selected stimuli, presented in random order. Thus, the main task consisted of 60 distractor trials, showing six different animals, 10 critical trials, showing the eagle, and 90 non-critical trials, showing musical instruments, carpenter's tools, and vehicles. Half of the participants reacted to living objects with their right index finger, and to non-living objects with the left finger. This was reversed for the other half of participants.

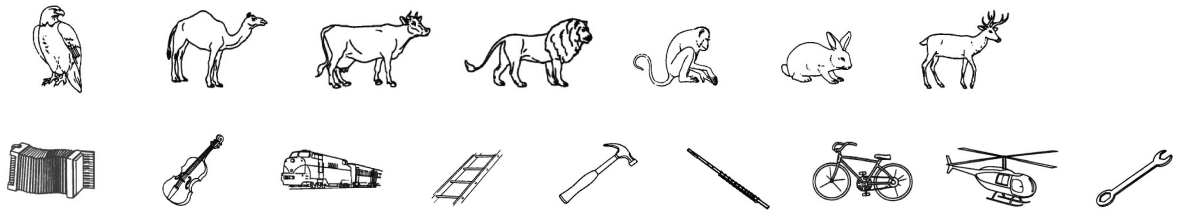

Figure 6. Stimuli used in Study 3. The first row shows living objects, the second row non-living objects. The eagle picture served as critical item.

Reaction Time Indices and Error Indices. We computed the mean RT of the critical trials as index for critical stimuli (M = 489 ms, SD = 56 ms), and two separate indices for distractor trials. In order to compare critical items with only the closely matched distractor items, we calculated a mean score of the matched items (M = 485 ms, SD = 45 ms) as well as the usual mean score of all distractor items (M = 484 ms, SD = 44 ms).

Error indices were computed by the same rationale as in Studies 1 and 2. This time, we did not only compute an error index for critical trials (M = .06, SD = .09), and an error index for all distractor trials (M = .04, SD = .03), but also for matched distractor items (M = .04, SD = .05).

Commitment and Difficulty. Commitment and perceived difficulty were assessed with the same items as in Study 1. Reliabilities were acceptable (commitment: α = .66; difficulty: r = .30, $p < .01$).

Manipulation. The so-called planning exercise inducing implementation intentions or control instructions remained virtually the same as in Study 2 only that participants were asked to prepare themselves for birds, raptors, or eagles with their respective planning instructions. The familiarization groups were given the same goal intention as the other groups but then had to write down “bird”, “raptor”, or “eagle” ten times, according to the specificity condition they were in. With this exercise we ensured that participants in the familiarization control group were as familiar with the critical stimulus as participants in the implementation intention group and in the control group. Thus, potential advantages could not be explained by priming effects.

Manipulation Check. In this study we included a manipulation check to control whether participants correctly encoded the so-called planning exercise. After they had finished working on the main task, we asked them to write down their planning exercise as precisely as they remembered it. Answers were coded in relation to predefined rules. Slight deviations from the

exact phrasing, such as abbreviations, were counted as correct answers. Eight participants either did not write down anything, indicated they did not remember the exercise or mentioned something completely different from their respective planning exercise. We excluded data of these participants from further analyses because their performance in the main task was unlikely to have been influenced by the manipulations.

Results

Preliminary analyses. Separate 3 (group: implementation intention vs. control vs. familiarization control) x 3 (specificity: bird vs. raptor vs. eagle) between subjects ANOVAs revealed that manipulations did not cause substantial differences in preliminary commitment or perceived difficulty. The main effect of group on commitment became marginally significant, $F(2, 123) = 2.60$, $p = .08$, all other effects were clearly non-significant (all ps > .24).

Testing Hypotheses. A 2-within (stimulus: critical vs. distractor) x 3-between (group: implementation intention vs. control vs. familiarization control) x 3-between (specificity: bird vs. raptor vs. eagle) ANOVA on reaction times using the index including all distractor items (see Table 3) revealed a marginally significant effect for stimulus, $F(1, 123) = 3.35$, $p = .07$, caused by faster reactions to distractor trials (M = 484 ms) than to critical trials (M = 489 ms). However, when implementing the distractor index for matched items only this effect was diminished, $F(1, 123) = 2.19$, $p = .14$. Instead, the interaction between group and stimulus became marginally significant, $F(2, 123) = 2.97$, $p = .06$. Simple main comparisons revealed only one significant difference: The contrast between critical and distractor items within the control group, $F(1, 123) = 6.58$, $p = .01$. Participants in the control group reacted significantly faster to distractor items (M = 477 ms) than to critical items (M = 488 ms).

Conducting the 2-within (stimulus: critical vs. distractor) x 3-between (group: implementation intention vs. control vs. familiarization control) x 3-between (specificity: bird vs. raptor vs. eagle) ANOVA on error indices using the distractor index for all trials revealed a significant main effect for stimulus, $F(1, 123) = 6.37$, $p = .01$. Participants reacted more accurately to distractor trials ($M = .04$) than to critical trials ($M = .06$). We repeated the analyses with the index for matched distractor items only, which resulted in a main effect of stimulus, $F(1, 123) = 5.09$, $p = .03$. This indicated once again that responses were more accurate for distractor trials ($M = .04$) than for critical trials ($M = .06$). None of the other effects reached significance (all ps > .37).

Table 3

Mean Reaction Times (ms) by Type of Stimulus Instruction (Study 3)

	Stimuli		
Instruction	Critical Items	Distractor Items (Index for All Distractors)	Non-Critical Items
Control Group			
Bird	488 (74)	472 (62)	482 (67)
Raptor	498 (52)	486 (35)	497 (42)
Eagle	475 (43)	472 (33)	481 (43)
Familiarization Control Group			
Bird	494 (54)	496 (44)	495 (39)
Raptor	493 (65)	492 (39)	502 (49)
Eagle	484 (63)	482 (46)	488 (51)
Implementation Intention Group			
Bird	500 (58)	494 (51)	492 (43)
Raptor	479 (37)	476 (40)	482 (32)
Eagle	485 (57)	485 (49)	482 (49)

Note: Standard deviations are in parantheses.

Potential Moderators. Similar to the previous studies, we tested whether commitment or perceived difficulty worked as moderators. Neither including the median-split commitment index nor the median-split difficulty index as factor in respective ANOVAs on reaction times led to any additional significant effect. This was the case regardless of whether the distractor index for all distractor items or for matched distractors was used.

Discussion

Even though we once more enhanced the experimental design in several ways, we could not confirm our hypotheses. Moreover, we still could not detect an implementation intention effect.

In Study 3 we used distractor items which were matched to the critical item with regard to familiarity and visual complexity. This led to a significant interaction between group and stimulus. Unfortunately, the data pattern did not display an implementation intention effect, indicating that implementation intention participants did not show shorter reaction times in critical trials than in distractor trials in comparison to control participants. Instead, the control group exhibited significantly faster reactions to distractor trials in comparison to critical trials. This is in line with our consistent finding of a main effect for stimulus, indicating faster and more accurate responses to distractor trials than to critical trials. By using a standardized set of pictures which was designed to match structural representations of participants we ruled out alternative explanations holding the stimulus material responsible. We again found a main effect for stimulus. The reason for this remains unclear. Also, the fact that all participants reacted faster and more correctly to distractor trials than to critical trials in our study is discrepant from previous findings. Including a less conservative familiarization control group did not change the pattern of our results.

Because of the complete lack of implementation intention effects we can neither approve nor reject our hypotheses concerning specificity, claiming that more specific implementation intentions led to faster reactions, while less specific implementation intentions led to slower reactions.

As repeated amelioration of the experimental design did not improve results and did not produce an implementation intention effect, we decided to continue with a different experimental setting, changing the type of task and stimuli fundamentally. Additionally, we wanted to test our third hypothesis, assuming that less specific implementation intentions enhance action initiation in several situations while specific implementation intentions are helpful only in the one situation they prepare participants for.

Study 4

In Study 4 we tested the complete set of hypotheses using a different experimental design. Because we did not succeed in finding an implementation intention effect in previous studies, we made some larger modifications. First, we made the whole task more realistic and engaging. We asked participants to do something which more closely parallels processes in real-life. Many studies proving implementation intention effects are field studies, examining natural behavior (Bamberg, 2002; Holland et al., 2006; Orbell & Sheeran, 2000). We presumed that we might detect implementation intention effects in a more realistic task. For our study, participants were instructed to take the role of an operator of a nuclear power plant, monitoring its progress on several parameters and correcting them if necessary. In order to give it a maximally realistic impression a special computer program was developed for our study (see below). Concurrently, the task and the goal to do well on the task were more difficult. As mentioned above, implementation intentions are more effective for difficult than for easy goals (Gollwitzer et al.,

2005; Gollwitzer & Brandstätter, 1997, Study 1). Thus, it became more likely to find implementation intention effects.

In order to test the third hypothesis, we included situations which posed good opportunities with regard to the goal intention and a global implementation intention, but for which a specific implementation intention did not apply. We assumed that a specific implementation intention is more effective than a global implementation intention when there is a close match with the situation encountered. For example, preparing oneself with the implementation intention "If I meet my friend Silvia, I am especially friendly to her." should work better than "If I meet a friend, I am especially friendly." if one in fact encounters Silvia. Performance in other situations also affording good opportunities for the superordinate goal intention, but not matching the specific implementation intention, would be fostered better by a global implementation intention than by a non-matching specific implementation intention. So, when meeting Tom instead of Silvia, the implementation intention "If I meet a friend, I am especially friendly." should work better than "If I meet my friend Silvia, I am especially friendly."

Furthermore, we included a measure of conscientiousness, because conscientiousness has been proven to be another moderator of implementation intention effects. A study by Webb and colleagues showed that implementation intentions were more beneficial for low to moderate conscientious people than for high conscientious people (Webb et al., 2007). Because we needed strong experimental control over conditions and circumstances while measuring participants' action initiation properly, we again relied on a reaction time task.

We expected participants to react fastest if they had formed a specific implementation intention and encountered the exact situation for which they had been prepared. Participants who

formed a less specific implementation intention should still be better than the control group but slower than the specific implementation intention group in that particular situation. Participants equipped with a global implementation intention should outperform those with a specific implementation intention if another situation occurred, for which the goal intention and the global implementation intention applied, but not the specific implementation intention.

Method

Participants. We recruited 133 participants through the university's subject pool. They received 20 CHF for participation or, if they preferred, course credit. Some participants had to be excluded from analyses due to language or sight problems, or because of the manipulation check or the subsequent interview revealed that they had misunderstood the task instructions. Some participants produced too many false alarms or too few critical events (see below). In total 31 participants were excluded for one or several of these reasons. This left 102 participants (59 women, 43 men) with a mean age of 23 years (SD = 3) as final sample.

Procedure. Participants were tested individually or in small groups of up to four persons in a lab room equipped with separate work places which were shielded from each other's view. On arrival participants were given short general information about the study. Then they received written instructions about the task before they underwent a training session on the computer which lasted 5 min. Following the training session they filled in a questionnaire containing the manipulations as well as items measuring commitment, difficulty, and conscientiousness. After they had filled in the questionnaire, the experimenter started the experimental session which lasted 15 min. Finally, participants filled in a second questionnaire, including the manipulation check. They were fully debriefed before leaving the lab.

Stimuli, Task and Design. Participants were told to imagine that they were an operator of a nuclear power plant and were asked to monitor the progress and make sure that there were no disturbances. In order to accomplish this they had to perform two tasks at the same time. Within a specially programmed computer task, their primary task was to monitor three diagrams supposedly showing voltage curves which had to be kept within marked limits. They were told how to use six different keys in order to increase or decrease voltage gradually if one of the voltage curves threatened to cross the limits. In a secondary task they had to monitor three predefined relevant warning lights, labeled Pump A (German: Pumpe A), Pump B (German: Pumpe B), and Coolant (German: Kühlmittel), in a panel of four rows and six columns of warning lights (see Figure 7). When these warning lights turned red they indicated potential problems within the power plant's system, which constituted the critical events. By pressing a yellow marked key participants could switch them back to green. The monitoring of the warning lights and reacting to them was the relevant task for the implementation intention manipulations. The three relevant warning lights did not return to the green status if no key was pressed. All other warning lights in the panel changed from green to red and back, providing some distraction from the critical warning lights.

Both the warning lights and the fluctuation of the voltage levels were programmed to vary according to probability functions. These were set in such a way that voltage levels could not rise or fall too abruptly and that the relevant warning lights changed to red within a reasonable time, providing sufficient necessity for reaction. The exact number of critical events varied because we wanted to keep processing time constant for all participants. Fixing processing time and number of critical events would have made appearance of critical events dependent of reactions to prior events, which had to be avoided. Consequently, the number of critical events

varied for the respective warning lights and for participants. We excluded two participants, because at least one of the warning lights never turned red and therefore there was no opportunity to react to it. For all other participants Pump A turned red 46 times (*SD* = 45), Pump B 46 times (*SD* = 47), and Coolant 45 times (*SD* = 39) on the average. Over all participants, each of the respective warning lights provided the necessity to react between 3 and 130 times.

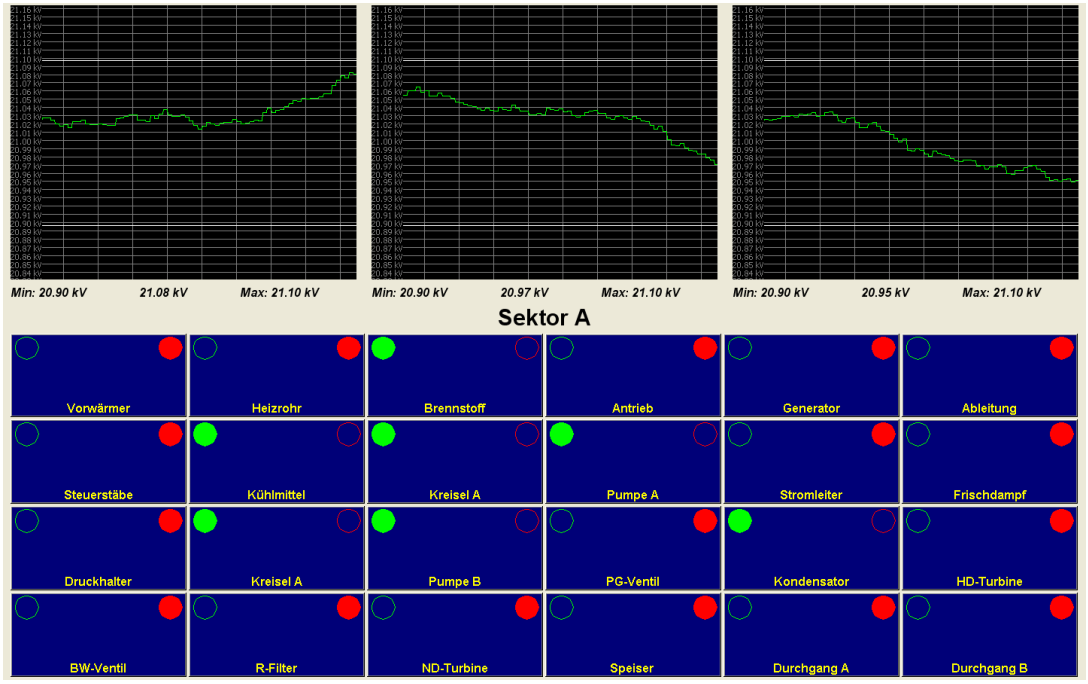

Figure 7. Screenshot showing the voltage curves and warning lights of the nuclear power plant. The relevant warning lights are “Kühlmittel” (Coolant), “Pumpe A” (Pump A), and “Pumpe B” (Pump B). All warning lights’ names are derived from the elements of a light-water reactor.

Taking the special features of the task (see below) into account, this led to a 3-within (stimulus: Pump A vs. Pump B vs. Coolant) x 2-between (group: implementation intention vs. control) x 3-between (specificity: all warning lights vs. pumps vs. Pump A) design.

Reaction Time Indices. On the average participants' reaction times was 3460 ms (*SD* = 2263 ms) for Pump A, 3056 ms (*SD* = 1650 ms) for Pump B, and 3203 ms (*SD* = 2094 ms) for Coolant. Because reaction times for all three warning lights were positively skewed, we took the common logarithm of the mean scores, computing separate indices for Pump A, Pump B, and Coolant. The logarithmized reaction time indices were no longer skewed and we therefore used these in further analyses.

Error Indices. Due to the set-up of the monitoring task the only possible errors were false alarms, that is, participants pressed the marked key though none of the three relevant warning lights had turned red. Consequently, we could not compute separate error indices for the different warning lights but instead counted the total number of false alarms and divided them by the total number of events. This index was also positively skewed in most conditions. Taking the logarithm did not change this, so we retained the non-transformed index.

Commitment, Difficulty, and Conscientiousness. Commitment and perceived difficulty were assessed using the same items as in Study 1. Additionally, we measured conscientiousness by applying the 16 PA (H. Brandstätter, Filipp, & Drescher, 1992). This instrument has been developed according to the German version of the 16 PF. It provides 32 adjective pairs, two for each of the 16 first order factors, and allows a reliable estimation of the 16 PF second order factors (H. Brandstätter et al., 1992). Participants have to indicate on a 9-point rating scale which adjective of a pair applies to them better. For the purpose of estimating second order factors like conscientiousness, standardized values are computed using regression coefficients from previous studies (H. Brandstätter et al., 1992).

Manipulation. All participants were asked to set themselves the goal to care for the plant's accurate processing by reacting as fast as possible to the voltage curves and the three

relevant warning lights. Then they were told that by following a so-called planning exercise they could improve their overall performance. Implementation intention participants wrote down the following sentence three times “If a relevant warning light turns red, I press the yellow key as fast as possible!”. The if-part varied slightly according to specificity. The more specific groups either wrote “If a relevant warning light for a pump turns red, …” or “If the relevant warning light for pump A turns red, …”. The planning exercise for the control group was “I react as fast as possible to relevant red warning lights. I press the yellow button as fast as possible.” Again, the first part varied according to specificity. Participants in the more specific groups prepared themselves either for “relevant red warning lights for pumps” or for “the relevant red warning light for pump A”. Thus, strictly speaking, the respective relevance of the warning lights depended on the specificity condition participants were in. One could say that participants in the most specific implementation intention group and control group had only one critical warning light (Pump A). Participants in the medium specific implementation intention group and control group prepared themselves for two critical warning lights (Pump A & Pump B). For implementation intention and control participants in the most global specificity condition all three warning lights were critical warning lights. In contrast to Studies 1 to 3, no absolute statement can be made about which constituted critical stimuli and which constituted distractor stimuli.

Manipulation Check. The manipulation check was carried out in the same way as in Study 3. Seventeen participants made wrong statements about the contents of their planning exercise and were excluded from further analyses (see above).

Results

Preliminary analyses. Conducting a 2 (group: implementation intention vs. control) x 3 (specificity: all warning lights vs. pumps vs. pump A) between subjects ANOVA on the difficulty index revealed a main effect for group, $F(1, 96) = 4.69$, $p = .03$. Participants in the control group thought that the task was more difficult ($M = 3.73$) than implementation intention participants ($M = 3.44$). Applying the same ANOVA on the commitment index did not lead to significant results (all *p*s > .14).

Testing Hypotheses. Because the total number of events per participants correlated significantly with reaction time indices for Pump A, Pump B, and Coolant ($r = -.75, -.70, -.64$, in the same order; all *p*s < .001), we used total number of events ($M = 137$, $SD = 56$) as a covariate in respective analyses.

We computed a 3-within (stimulus: Pump A vs. Pump B vs. Coolant) x 2-between (group: implementation intention vs. control) x 3-between (specificity: all warning lights vs. pumps vs. pump A) ANCOVA on reaction time indices with the total number of critical events as covariate. While the covariate was significant, $F(1, 95) = 520.36$, $p < .001$, none of the experimental effects reached significance (all *p*s > .14).

We also performed a 2 (group: implementation intention vs. control) x 3 (specificity: all warning lights vs. pumps vs. pump A) between subjects ANOVA on the error index to control for a possible speed-accuracy trade-off. Though again the covariate was significant, $F(1, 95) = 4.78$, $p = .03$, none of the other effects reached significance (all *p*s > .44).

Table 4

Mean Reaction Times (ms) by Type of Stimulus and Instruction (Study 4)

	Stimuli		
Instruction	Pump A	Pump B	Coolant
Control Group			
All Warning Lights	3523 (2464)	4090 (2414)	3379 (2372)
Pumps	3338 (2687)	3077 (1822)	3400 (2722)
Pump A	3124 (1637)	2751 (1233)	2920 (1766)
Implementation Intention Group			
All Warning Lights	3340 (1913)	2830 (1540)	2874 (1738)
Pumps	2922 (2014)	2184 (971)	3288 (2102)
Pump A	4602 (2825)	3433 (957)	3483 (2173)

Note: Standard deviations are in parantheses.

Potential Moderators. As before, we tested whether difficulty or commitment moderated the effects. Including the median-split difficulty index as additional factor to the above described ANCOVA did not lead to a significant four-way interaction. It did not moderate the hypothesized effect, but it produced a marginally significant interaction between stimulus, specificity, and difficulty, $F(4, 178) = 2.20$, $p = .07$. Using the median-split commitment index instead of the difficulty index yielded no moderation either. Instead, a marginally significant main effect for stimulus occurred, $F(2, 178) = 2.83$, $p = .06$, indicating that participants reacted fastest to Pump B ($M = 3077$ ms), but slower to Pump A ($M = 3212$ ms) and Coolant ($M = 3465$ ms).[4]

[4] For better understanding, non-transformed means are given, even though analyses were performed on the logarithmized indices.

In Study 4 we had additionally measured conscientiousness because it has been reported to moderate implementation intention effects. Thus, we also tested whether conscientiousness worked as moderator in our study by including the median-split conscientiousness index as additional factor leading to a 3-within (stimulus: Pump A vs. Pump B vs. Coolant) x 2-between (group: implementation intention vs. control) x 3-between (specificity: all warning lights vs. pumps vs. Pump A) x 2-between (conscientiousness: low vs. high) ANCOVA. None of the effects reached significance.

Discussion

Once again, we could not confirm our hypotheses. We found none of the assumed effects and in none of the additional analyses we could identify a moderating variable. Specific implementation intentions that matched the situation were no more powerful than global implementation intentions. Neither was the opposite true when there was no match between the specific implementation intention and the occurring situation. In other words, we could not prove that global implementation intentions are applicable to a larger set of good opportunities for goal-directed behavior and that they are inferior to a specific implementation intention when there is a match between the situation and the specific implementation intention. We could not even detect an implementation intention effect regardless of specificity.

In the following we will discuss the results in more detail with regard to the respective situation (i.e., the reactions towards the respective warning lights). Even though participants in the control group believed that the task was more difficult than did implementation intention participants, they did descriptively better than implementation intention participants regarding reaction times to Pump A. When considering the complete descriptive data pattern for reactions to Pump A control participants seem to be faster at all levels of specificity. This is most

convincingly the case at the most global level of specificity. Hence, the results are in total contrast to our hypotheses. We expected implementation intention participants with the most specific implementation intention to be fastest with regard to reaction times for Pump A. Why all implementation intention participants were slower when reacting to Pump A remains unclear, especially as they outperform control participants when we regard the data pattern for Pump B.

For Pump B descriptive analysis of the data suggests an implementation intention effect. Participants who were prepared to react to pumps (medium level of specificity) were fastest in their reaction to Pump B. This is at least partly in line with our assumptions. In addition to that we would have expected them to be faster than control participants when reacting to Pump A which was not the case. Further, concerning reactions to Pump B implementation intention participants who were prepared for all warning lights (the most global level of specificity) seem to outperform control participants. When they had been prepared to react to Pump A (the highest level of specificity, but not matching the situation perfectly) and Pump B turned red, it did not matter whether participants held an implementation intention or if they did not, they were as fast as control participants. Additionally, still considering reactions to Pump B, there is a descriptive tendency towards a general specificity effect for both groups: Higher levels of specificity lead to faster reactions. The only exception is the most specific implementation intention group. Participants who held a specific implementation intention concerning Pump A were just as slow as the respective control group when Pump B turned red. This general pattern for reaction times to Pump B is in line with our hypotheses.

The pattern for Coolant is not as promising. While most groups revealed similar RTs, the implementation intention group which was prepared to react to pumps was slowed down considerably. Participants who were prepared very specifically did not show slower reaction

times and participants who were prepared more globally (and therefore more adequately for their reactions to Coolant) were not faster. Furthermore, implementation intention participants showed no general advantage over control participants; instead they were even slower than controls at the medium level of specificity. Taken together it can be stated that while reaction times for Pump B revealed a promising descriptive pattern, RTs for Pump A and Coolant show no systematic and interpretable pattern. And because none of the effects reached significance we cannot draw any conclusions from this pattern.

Considering conscientiousness as another potential moderator did not clarify the results either. Rather, we found yet other significant effects for difficulty and commitment. Neither of them contributed to a more conclusive pattern, nor did they replicate effects from previous studies.

Altogether, we conclude that changing the experimental design did not lead to any conclusive evidence for our hypotheses. Even though we considered yet another potentially moderating variable, we could not detect an implementation intention effect regardless of specificity.

General Discussion

In a series of four studies we scrutinized whether implementation intention effects depended on their respective level of specificity. We predicted that more specific implementation intentions are most helpful in the exact situations they specify while less specific implementation intentions produce decreased effects, but that these effects would be present in more situations. Throughout all studies we failed to find implementation intention effects, regardless of level of specificity. Neither very specific nor more global implementation intentions enhanced participants' reactions beyond those of the control group. Because we found no implementation

intention effect we cannot make any conclusions about the relevance of specificity. Nevertheless, we will speculate about possible explanations why there were no effects.

Although we approximated standard procedures (V. Brandstätter et al., 2001; Webb & Sheeran, 2004) increasingly throughout the first three studies we could not detect any of the predicted effects. This holds true for reaction times as well as for errors. Thus, we can rule out that participants misunderstood our instructions and focused on being accurate rather than on being fast. What is more, not even descriptive data analyses revealed a conclusive pattern. They did not clearly hint at deficiencies in the experimental design nor did they suggest alternative explanations. Also, descriptively comparing reaction times from our first three studies with similar studies (V. Brandstätter et al., 2001; Webb & Sheeran, 2004) did not reveal noticeable differences between means. While mean RTs in our studies ranged from 409 ms to 547 ms, mean RTs in Webb and Sheeran's studies (2004, Experiments 2 & 3) ranged from 401 ms to 496 ms. In the study conducted by Brandstätter et al. (2001) they ranged from 371 ms to 516 ms. Hence, the range of reaction time scores in our studies lies within the range of reaction time scores obtained in similar studies. This suggests that there were no problems in our experimental designs. Taking known moderators of implementation intention effects into account such as goal commitment (Sheeran et al., 2005), perceived difficulty of the task (Gollwitzer & Brandstätter, 1997, Study 1), or conscientiousness (Webb et al., 2007) did not clarify results.

A possible explanation for the lack of effects could still reside in the fact that we used pictures as stimuli instead of letters or numbers as in previous studies (V. Brandstätter et al., 2001; Webb & Sheeran, 2004). It was necessary to use pictures in order to phrase implementation intentions of different specificity levels. It is possible that participants had more difficulty to categorize pictorial material than they had with categorizing verbal material in

previous studies. In contrast to this assumption Glaser (1992) found that pictures are generally categorized more easily than words. This renders it unlikely that the lack of effects in our study was due to the type of material used.

Another potential explanation is that the verbal format of the implementation intention interfered with the pictorial format of the stimulus material. The fact that we asked implementation intention participants to prepare themselves by internalizing and rewriting a sentence might have led to an advantage precisely for the preactivated stimuli (i.e., a representation of the written words plant, flower, rose, or bird, raptor, eagle). To test this possibility, we are currently preparing another study similar to Study 3. We intend to use exactly the same instructions except that half of the participants will have to react to words instead of pictures. Unfortunately, this brings new problems concerning the experimental design. It is impossible to provide participants who have a more global implementation intention with a pictorial cue on the same level of specificity, that is, a less specific picture of a bird. Of course, a picture will always show some specific bird or at least instigate associations with a specific bird. Thus, pictorial stimuli will always match specific implementation intentions more closely than global implementation intentions. This is not necessarily the case with verbal stimulus material. Either, we design the verbal stimuli according to the pictorial material or we match them more closely to the level of specificity used in participants' implementation intentions. On the one hand, if we choose the first option and find an enhancement for participants with a very specific implementation intention using verbal stimuli it will remain unclear whether the specificity of planning caused the effect or whether it was caused by the match between planning instructions and stimulus material. On the other hand, if we choose the second option and find effects, the operationalized levels of specificity will be confounded with the format of the stimulus material

and will also lead to interpretation problems. Because this study is still in preparation, we cannot rely on its possible results. If our assumption can be proven and the type of stimuli for which implementation intentions are formed plays an important role for the effectiveness of implementation intentions, this would have relevant implications for further research as well as for practical application. For example, planning to enhance regular tooth flossing would be more effective if we mentally visualize our tooth brush than if we prepare ourselves by using respective verbal instructions. On the contrary, trying to change one's tooth paste for a healthier product might be more effective if one internalizes an implementation intention concerning the product's name verbally ("If I go shopping, then I buy TOOTH-HEALTH!").

Because we did not find an implementation intention effect within Studies 1 to 3, we used a completely different experimental design in Study 4. We implemented a more realistic monitoring task, asking participants to act as operators of a nuclear power plant. By introducing a second task and distracting irrelevant warning lights, we made the whole task more difficult. By increasing cognitive load we hoped to provoke implementation intention effects (cf. V. Brandstätter et al., 2001). Unfortunately, this did not work either. Although descriptive analyses of reaction times of Pump B looked promising, data for Pump A and Coolant did not reveal any conclusive pattern. It is of course possible that even though we made an effort to introduce and design the task as realistically as possible, it remained rather sterile and unappealing to participants. As most participants were rather involved in the task and many reported that they had enjoyed it, it is unlikely that it was unattractive and that participants did not really engage in working on it.

Considering the task's external validity, the possibility remains that psychological processes necessary for reaction time tasks differ from those necessary for real life projects.

Maybe specificity of implementation intentions is important for macro processes needed to realize plans in real life while they do not play a role for micro processes needed to fulfill laboratory tasks. As we did not find implementation intention effects in any of our studies, we cannot go beyond speculation when concluding anything about the moderating role of specificity.

Nevertheless, yet another study is in preparation in which specificity of implementation intentions is manipulated. We will instruct participants with implementation intentions of different levels of specificity to enhance environmentally responsible behavior (i.e., energy conservation). This will be studied in a field experiment similar to other implementation intention research (Bamberg, 2002; Holland et al., 2006), enabling a truly naturalistic context. Maybe there will be implementation intention effects in this completely different context and building on this we can take a closer look at the relevance of specificity.

As mentioned above, we cannot draw any conclusions concerning the relevance of specificity from our studies, because there was no implementation intention effect. However, evidence from related research on prospective memory suggests that the specificity of the instruction plays a role (Marsh, Hicks, Cook, Hansen, & Pallos, 2003). Studies on prospective memory are concerned with the memory processes involved in remembering to perform an activity in the future. In these studies participants typically perform an ongoing task in which cues for an additional prospective memory task are embedded. For example, after participants memorized word pairs, they have to work on a lexical decision task including some of the previously learned words. Whenever the first word of a learned pair appears, participants are asked to speak out the second word (for a more detailed description of an experimental design in prospective memory research see A.-L. Cohen & Gollwitzer, 2008). While prospective memory

and processes underlying implementation intention effects have much in common, they do not describe the same phenomenon. Rather, implementation intentions can be considered as a subpart of prospective memory, or more precisely, a strategy that transforms an ill-defined prospective intention into a more clearly defined one, thereby enhancing the probability of its successful enactment. As already mentioned, research on prospective memory demonstrated that specificity might be important. In a study conducted by Marsh et al (2003), participants were asked to do a lexical decision task on a computer as ongoing task. For the prospective task participants had to press another key whenever an animal appeared. This was introduced using either a specific description (pressing the key when "dog" appeared) or a more global description (pressing the key if the word belonged to the category of animals). For the participants prepared to react to "dog" only "dog" ever was the prospective cue. For participants prepared to react to animals, different animal names appeared. In this experiment, detection of the prospective cues was better if participants had been more specifically prepared. Additionally, responses in the ongoing task were slowed down if participants had a categorical intention in comparison to when they had a specific intention (Marsh et al., 2003). These results suggest that specificity of preparation plays a role for subsequent performance. However, participants were not explicitly instructed to form implementation intentions and it remains unclear whether the instructions to react to the prospective cue were encoded in the format of a goal intention or whether they spontaneously formed an implementation intention. Thus, we cannot be sure whether the effect was caused by specificity of a goal intention or by specificity of an implementation intention. Maybe a replication of the study with additional implementation intention instructions could clarify this question and at the same time illuminate the relevance of specificity for the effectiveness of implementation intentions.

Another potential problem with our studies could lie in the levels of specificity. The levels of specificity we implemented in our studies may have been either too global or too specific to produce implementation intention effects. By comparing our instructions with instructions from other studies this seems unlikely. Several studies proving implementation intention effects used instructions which closely resembled our specific implementation intentions (V. Brandstätter et al., 2001; Webb & Sheeran, 2004, 2007; Wieber & Sassenberg, 2006). Furthermore, implementation intention effects have been demonstrated in studies which used even less specific implementation intentions than our global implementation intentions (Achtziger et al., 2008; Bayer & Gollwitzer, 2007). Hence, we can rule out the possibility that the operationalized levels of specificity forestalled implementation intention effects.

Also, we can be rather sure that our operationalization of control groups was not responsible for the lack of implementation intention effects. On the one hand, other studies also used rather conservative control group instructions and paralleling implementation intention instructions and found implementation intention effects (Wieber & Sassenberg, 2006). On the other hand, in Study 3 we included a less conservative control group which only had to familiarize with the critical stimuli but did not do a planning exercise. This did not lead to implementation intention effects either.

In conclusion, we attempted to parallel previous studies and also used new and enhanced designs, but failed to find at least implementation intention effects. Although it is plausible to assume that specificity moderates implementation intention effects, we could neither reject nor confirm this hypothesis. In order to rule out further deficiencies of our studies, new experiments are in preparation, hopefully searching for respective effects more successfully.

Conclusion

Research on implementation intentions has answered the three generations of questions a comprehensive research program is supposed to ask (Zanna & Fazio, 1982). First, the general effectiveness of implementation intentions for a variety of behaviors and self-regulatory problems has been shown (for an overview see Gollwitzer & Sheeran, 2006). Second, mechanisms behind the effectiveness of implementation intentions have been identified. It has been suggested that automaticity is the general mechanism enhancing the enactment of goal-directed behavior, fostered by the component processes of situational and behavioral readiness (Webb & Sheeran, 2007, 2008). Finally, research has started to identify moderating variables. While basic preconditions for the effectiveness of implementation intentions have been established a long time ago, many questions concerning potential moderators remain open. With the present studies we intended to answer at least some of them.

In a first set of studies, we demonstrated that the individual difference variable action-state orientation predicted behavior for different of self-regulatory problems and moderated implementation intention effects. We further specified its moderating effect: action and state oriented individuals' performance was enhanced differentially by implementation intentions. Taking different self-regulatory problems into account, either action oriented people or state oriented people were better in performing respective goal-directed behaviors. First, profit could be gained from implementation intentions when self-initiation of action was necessary. Even though action oriented individuals who were already doing well on the task did not gain additional benefits from implementation intention, state oriented individuals could enhance their performance. Second, when detailed planning was required in a complex decision making task, implementation intentions did not only help action oriented participants, but also hindered state oriented individuals who did well without implementation intentions. Thus, the self-regulatory

problem at hand has to be considered as well as the moderating variable, because action-state orientation might differentially influence the effectiveness of implementation intentions in different situations. We could show for action-state orientation, which comprehensively and directly relates to self-regulatory competence, that implementation intentions, though helpful in many occasions, are not the best strategy for everyone in every situation. Special care should be taken when giving instructions to form implementation intentions in applied settings. Specifically, the self-regulatory problem and the individual disposition should be taken into account. More detailed research concerning the circumstances under which individual differences influence the effectiveness of implementation intentions his is needed, as well as more research on how exactly individual differences influence implementation intention effects.

In another set of studies we tried to prove another moderator of implementation intention effects, that is, the level of their specificity. We followed similar studies and also tried new designs but we were unable to detect an implementation intention effect in any of the four studies. Hence, it must be assumed that there remain still other, yet unidentified basic requirements that have to be met in order to establish implementation intention effects. We reasoned that consistency between the format of implementation intentions and the encountered stimuli might play an important role. Further clarification of basic requirements seems profitable for further research and for the usage of the volitional strategy of implementation intentions in more applied contexts.

Finally, we point out that the identification of moderating variables of implementation intention effects encounters methodological constraints. Implementation intentions are a powerful tool to enhance the enactment of goal-directed behavior. It is possible that we failed to detect all effects. Many goals can be either reached or not. For such goals there are no shades of

success. In other words, the use of implementation intentions might have produced ceiling effects on the measures of performance. Thus, if a person remembers to give his/her grandmother a call because it is her birthday, he/she can do no more about this. While this is no problem for practical applications of implementation intentions, it might lead to an underestimation or rejection of some effects which are theoretically important. For example, in our studies on action-state orientation we found that action-oriented individuals did not further benefit from using implementation intentions. However, we cannot rule out that this was the case only because of our dependent measure. It is impossible to send back an answering card more timely than “on time”. Thus, it is possible that action-oriented individuals still benefit from using implementation intentions in other tasks when it is possible to further enhance goal-directed behavior. This might be the case for behaviors for which it is necessary to repeat a certain action again and again (e.g., health behaviors like vitamin pill intake or breast self-examination). But examining repeated behaviors might be difficult for another reason: it is difficult to decide if an implementation intention is still effective or if a habit has already been established and taken over behavioral control. Thus, exploring moderating variables of implementation intention effects remains methodologically challenging.

Altogether, we conclude that while we could at least partly identify moderating variables and thus provide more information about the applicability and the limits of implementation intentions, more research will be needed to fully understand how and for whom implementation intentions are the key to success.

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Curriculum Vitae

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Education

Aug. 2004 – Nov. 2009	Doctoral student at the University of Zürich, Switzerland, Department of Psychology (Psychology of Motivation, Volition and Emotion), Prof. Dr. Veronika Brandstätter-Morawietz;
Oct. 1998 – Oct. 2004	Studies of psychology at the Georg-Elias-Müller Institute for Psychology of the Georg-August University at Göttingen, Diploma, grade 1.22 (very good); diploma thesis: Social comparison effects in a preparatory attention design
1984 – 1997	Primary and higher education in Buxtehude, Germany (final secondary-school examination Abitur, grade 1.0 (very good))

Professional Experience

since Aug. 2004	Assistant (teaching and research) at the Department of Psychology, University of Zürich, Psychology of Motivation, Volition and Emotion, Prof. Dr. Veronika Brandstätter-Morawietz
since Aug. 2004	Implementation of the Zürich civil courage training in several training and train-the-trainer contexts with Prof. Dr. V. Brandstätter-Morawietz
1997-1998	Voluntary social year („Freiwilliges Soziales Jahr“) in the Christophorus-School at Hamburg, Germany, a school for children with attentional deficits and behavioural disorders

Extracurricular Activities / Projects

Oct. 2000 – Aug. 2004	Conceptualization and implementation of a training promoting “civil courage” (German: Zivilcourage) with Prof. Dr. Margarete Boos and Dr. Kai Jonas at the Georg-Elias-Müller Institute for Psychology, Göttingen
May 2001 – July 2004	Member of the „pakiju“-project Göttingen (working with socially problematic children in a play-therapy like setting, following a person-centred approach, accompanied by weekly supervision)
March – June 2003	Research internship at the Laboratoire de Psychologie Cognitive, Marseille with Prof. Dr. Pascal Huguet, development of an experimental design, data collection, and analysis; continuation of a cooperation for my diploma thesis

Oct. 2000 – March 2003	Student research assistant in a funded research project on spatial cognition, project director Dr. Steffen Werner, at the Georg-Elias-Müller Institute for Psychology, Göttingen
Oct. 2001 – July 2002	Statistics tutor for first year psychology students
Aug. – Nov. 2001	Internship in a project fostering the creativity and personality development of highly gifted children (course mentoring and testing of intellectual ability) under supervision of Dr. Ch. Mann, Göttingen

Publications

Jonas, K. J., Boos, M., Backes, S., Büttner, N., Ehrenthal, J., & Prasse, A. (2002). Göttinger Zivilcourage-Training [Training for the promotion of civil courage]. *Polizei und Wissenschaft, 1*, 72-82.

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Congress Contributions

Backes, S., & Jonas, K.J. (2004). Bei Ausländern schaut man weg! Verhaltensreaktionen auf kategoriales Priming [Looking the other way if it concerns foreigners. Behavioral reactions on categorical priming]. In T. Rammsayer, S.Grabianowski S. Troche (Eds.), 44. Kongress der Deutschen Gesellschaft für Psychologie, S. 284. Lengerich: Pabst Science Publishers.

Backes, S., & Brandstätter, V. (2006, September). Intentionsrealisierung und volitionale Kompetenzen [Intention realisation and volitional competencies]. Poster presented at the 45. Kongress der Deutschen Gesellschaft für Psychologie, Nürnberg, Germany.

Backes, S., & Brandstätter, V. (2006, September). Realisation of intentions and volitional competencies. Poster presented at Research on motivation. Snapshots or global picture? 10th International Conference on Motivation, Landau, Germany.

Backes, S., & Brandstätter, V. (2007, July). Whom do implementation intentions help and how specific should they be? Summer School Limits of Intentionality, University of Konstanz, Konstanz, Germany.

Backes, S., & Brandstätter, V. (2007, September). Wirksamkeit von Implementierungsintentionen: Die moderierende Rolle von volitionalen Kompetenzen [Effectiveness of implementation intentions: The moderating role of volitional competencies]. Paper presented at the 11. Tagung der Fachgruppe Sozialpsychologie, Freiburg i.Br., Germany.